ARMED FORCES CHEMICAL JOURNAL

Maj. Gen. William M. Creasy, Chief Chemical Officer, U. S. Army

NOVEMBER-DECEMBER, 1954

ARMED FORCES CHEMICAL JOURNAL

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COVER PHOTO

Major General William M. Creasy, Chief Chemical Officer, Department of the Army, at his desk in Washington, D.C. The newly appointed Chemical Corps chief, an inveterate pipe smoker, is also prone to pick up and hold some object in one or both hands as he ponders or discusses a problem.

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ASSOCIATION NEWS

DIRECTORS' MEETING

President Nathaniel S. Prime gave a brief review of the affairs of the Association since he assumed office last May, at the midyear meeting of the Board of Directors held at The Hotel New Yorker at 7:30 P. M. on September 16. A statement of the Association's finances was read and Admiral Prime introduced Lt. Colonel O. E. Roberts, the new secretary-treasurer, who told of the current effort of his office toward increasing membership and advertising revenue.

Mr. Lew Terry, president of the Midwest Chapter, headquarters Chicago, responded to a request to speak about the current activities of his chapter toward increasing membership.

Major General Charles E. Loucks, Deputy Chief Chemical Officer of the Army talked informally on relationships of the Association and the Chemical Corps.

EDWIN C. KENTON

Mr. Edwin C. Kenton, vice-president of the Evans Research & Development Corporation, New York, N. Y., and past president of the New York Chapter of A.F.C.A., died on August 19 while on a business trip in Chicago. His residence was at 340 East Fifty-second Street, New York City. Mr. Kenton had been active in A.F.C.A. affairs and had been awarded the Association plaque for sponsoring new members. He was a member of the Advisory Committee on Food of the National Academy of Science-National Research Council. During the war he served as intelligence officer with the Foreign Economic Administration. He was a member of the Chemists' Club and the Cornell Club of New York.

MIDWEST CHAPTER

Midwest chapter with headquarters in Chicago, had a large turnout for its meeting in Chicago on October 14 for which occasion the Hon. John Slezak, Under-Secretary of the Army was the guest speaker.

FORT McCLELLAN, ALA. CHAPTER

The Fort McClellan Chapter held its first monthly dinner meeting of the fall quarter 1 September at Remington Hall. Among the eighty-eight members and guests present were the new post commander, Colonel William T. Moore, and Mrs. Moore; Lt. Colonel Eleanore C. Sullivan, Commanding Officer of the Women's Army Center, recently established at Fort McClellan; Colonel George W. Dorn, chapter president; Colonel Edwin Van Keuren, past-president of the chapter and director-at-large of the Association; Mr. Leonard H. Roberts, vice-president and manager of the Classe Ribbon Works; and Mr. Marshall Hunter, president of the First National Bank in Anniston, Alabama, and Mrs. Hunter.

The new officers of the chapter are Colonel George W. Dorn, president; Lt. Colonel Truett K. Grant; 1st vice-president; Lt. Colonel James E. Rogers, 2nd vice-president; Lt. Colonel Edmundo Escudero, secretary-treasurer; and Lt. Colonel Wilson Thomas, Dr. Donald A. Springer Jr., Major Gregg Henry, and Mr. Mark H. Phillips, directors.

Left to right: Mr. Leonard H. Roberts, guest speaker; Mrs. Van Keuren; Colonel Dorn, chapter president; Mrs. William T. Moore, wife of the new commanding officer at Ft. McClellan; and Colonel Edwin Van Keuren.

Colonel Van Keuren reported on the ninth annual meeting of the Association in Washington, D. C. last May and presented AFCA plaques for meritorious service to Colonel Dorn and Lt. Colonel Escudero.

The speaker for the evening, Mr. Leonard H. Roberts, was introduced by Mr. Hunter and spoke on the "General Economic Trends in Manufacturing."

ARMY CHEMICAL CENTER, MD. CHAPTER

Mr. Gerald J. Fleming is the new president of the Army Chemical Center Chapter. Other officers elected at the fall meeting in September are: Lt. Col. Russell Tegnell, vice-president for organization and membership; Col. J. H. Rothschild, vice-president for meetings; Mr. Randolph Monro, secretary-treasurer, and Mr. Edmund H. Schwanke, past president, Dr. Carl N. Marquand and Lt. Col. Arthur E. Talbot, directors. The immediate past president of this chapter is Dr. William H. Summerson.

BALTIMORE CHAPTER

Mr. W. R. Greer, vice-president of The Pemco Corporation of Baltimore was elected president of the Baltimore chapter of the A.F.C.A., at a meeting held at the Fifth Regiment Armory on 20 August. Other new officers named: Mr. O. Q. Hendrickson, Lieut. Col. J. W. Gost and Mr. R. C. Crippen, first, second and third vice-presidents, respectively; and Mr. Raymond S. Bailleul, secretary-treasurer, (address, 1418 Third Road, Baltimore 20). Captain Paul I. Bauman, past president, and Col. E. M. Hoshall were named members of the Advisory Council. Admiral N. S. Prime, national president of A.F.C.A., addressed the meeting. An organization chart for the chapter and plans for future activities were discussed.

WILMINGTON, DEL. CHAPTER

The following officers were elected for 1955 at a meeting of the Wilmington chapter on 21 September: president, Mr. H. J. McCauley; first vice-president, Colonel W. J. D'Espinosa; second vice-president, Mr. A. L. Churchill; secretary-treasurer, Dr. R. T. Hall. Guest speaker at the meeting was Colonel J. C. Murray, Jr., Director, Policy Analysis Division, Headquarters, U. S. Marine Corps, Washington, D. C., who spoke on the subject "Contrasting Doctrines on the Treatment of War Prisoners in the Korean War." Additional guests at the meeting were introduced by Mr. H. N. Marsh. They were Colonel F. H. Barnes, Chief, Delaware Military District; Commander R. E. Duppenthaler, Chief, Naval Reserve District; and Major Mitchel, University of Delaware.

GROUP AND SUSTAINING MEMBERS

OF THE ARMED FORCES CHEMICAL ASSOCIATION

Abbott Laboratories, North Chicago, Ill.
Aerial Products, Inc., Elkton, Md.
Air Reduction Company, Inc., New York, N. Y.
Allen Products Corp., Nashville, Tenn.
Allied Chemical & Dye Corporation, New York, N. Y.
American Aniline Products, Inc., New York, N. Y.
American Cyanamid Company, New York, N. Y.
American Zinc, Lead & Smelting Co., St. Louis, Mo.
Armour & Company, Chicago, Ill.
Armstrong Cork Company, Lancaster, Pa.
Atlas Powder Company, Wilmington, Del.
Baker & Company, Inc., Newark, N. J.
Baker, J. T., Chemical Company, Phillipsburg, N. J.
Bastian-Morley Co., Inc., LaPorte, Indiana
Bechtel Corporation, San Francisco, Calif.
Bell & Gossett Company, Morton Grove, Ill.
Benjamin Reel Products, Inc., Cleveland, Ohio
Blaw-Knox Company, Pittsburgh, Pa.
Blickman, S., Inc., Weehawken, N. J.
Bridgeport Brass Company, Bridgeport, Conn.
Brown Company, Berlin, N. H.
Buffalo Electro-Chemical Company, Inc., Buffalo, N. Y.
Casco Products Corporation, Bridgeport, Conn.
Celanese Corporation of America, New York, N. Y.
Central Foundry Company, The, Newark, N. J.
Chamberlain Corporation, Waterloo, Iowa
City Chemical Corp., New York, N. Y.
Columbia-Southern Chemical Corp., Pittsburgh, Penna.
Continental Can Co., Inc., Chicago, Ill.
Continental Oil Co., Ponca City, Okla.
Crane Company, Chicago, Ill.
Curtis Industries, Inc., Helene, Chicago, Ill.
Diamond Alkali Company, Cleveland, Ohio
Dow Chemical Company, Midland, Mich.
E. I. duPont de Nemours & Co., Inc., Wilmington, Del.
Edo Corporation, New York, N. Y.
Eldon Manufacturing Company, Los Angeles, Calif.
Empire Stove Company, Belleville, Ill.
Endicott Johnson Corporation, Endicott, N. Y.
Evans Research & Development Corp., New York, N. Y.
Federal Laboratories, Inc., Saltsburg, Pa.
Ferguson, H. K., Company, The, Cleveland, Ohio
Ferro Corporation, Cleveland. Ohio
Firestone Industrial Products Co., Fall River, Mass.
Fisher Price Toys, Inc., East Aurora, N. Y.
Fisher Scientific Co., New York, N. Y.
Fluor Corp., Ltd., The, Los Angeles, Calif.
Food Machinery & Chemical Corporation, New York, N. Y.
Foster Wheeler Corporation, New York, N. Y.
Fram Corporation, Providence, R. I.
Fraser & Johnston, San Francisco, Calif.
Gasket, Packing & Specialty Co., Inc., New York, N. Y.
General Aniline & Film Corporation, New York, N. Y.
General Tire & Rubber Company, The, Wabash, Ind.
Goodrich, B. F., Chemical Company, Cleveland, Ohio
Goodyear Tire & Rubber Company, Akron, Ohio
Gray Stamping & Manufacturing Co., Plano, Ill.
Gulf Oil Corporation, Pittsburgh, Pa.
Haertel, Walter, Company, Minneapolis, Minn.
Handy & Harman, New York, N. Y.
Harshaw Chemical Company, The, Cleveland, Ohio
Harvey Machine Co., Inc., Torrance, Calif.
Hercules Powder Company, Wilmington, Del.
Hesse-Eastern Corporation, Cambridge, Mass.
Heyden Chemical Corporation, New York, N. Y.
Hooker Electrochemical Company, Niagara Falls, N. Y.
Howell Company, The, St. Charles, Ill.
Hyman, Julius & Company, Denver, Colo.
Industrial Rubber Goods Company, St. Joseph, Mich.
International Business Machines Corporation, Endicott, N. Y.
International Nickel Co., Inc., New York, N. Y.
International Salt Co., Inc., Scranton, Pa.
International Silver Company, Meriden, Conn.
Jefferson Chemical Company, Inc., New York, N. Y.
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
Kennecott Copper Corporation, New York, N. Y.
Kilgore, Inc., Westerville, Ohio
Koppers Company, Inc., Pittsburgh, Pa.
Kwikset Locks, Inc., Anaheim, Calif.
LaBelle Industries, Inc., Oconomowoc, Wisc.
Lambert Pharmacal Company, St. Louis, Mo.
Little, Arthur D., Inc., Cambridge, Mass.
Mason, L. E., Company, Hyde Park, Mass.
Mathieson Chemical Corporation, Baltimore, Md.
Merck & Company, Inc., Rahway, N. J.
Milwaukee Stamping Co., Milwaukee, Wisc.
Moe Light, Inc., Ft. Atkinson, Wisc.
Monarch Aluminum Mfg. Co., Cleveland, Ohio
Monsanto Chemical Company, St. Louis, Mo.
National Fireworks Ordnance Corp., West Hanover, Mass.
Niagara Alkali Company, New York, N. Y.
Niagara Blower Co., New York, N. Y.
Nopco Chemical Co., Inc., Harrison, N. J.
Oldbury Electro-Chemical Co., Niagara Falls, N. Y.
Olin Mathieson Chemical Corp., East Alton, Ill.
Oronite Chemical Company, San Francisco, Calif.
Parsons, Ralph M., Company, The, Los Angeles, Calif.
Pemco Corporation, Baltimore, Md.
Penick, S. B., & Company, New York, N. Y.
Pennsylvania Salt Manufacturing Co., Philadelphia, Pa.
Pfizer, Chas. & Company, Inc., Brooklyn, N. Y.
Philco Corporation, Philadelphia, Pa.
Phillips Petroleum Company, Bartlesville, Okla.
Pittsburgh Coke & Chemical Co., Pittsburgh, Pa.
Rau Fastener Co., The, New York, N. Y.
Ric-wiL Company, Barberton, Ohio
Rohm & Haas Company, Philadelphia, Pa.
Rudy Manufacturing Co., Dowagiac, Mich.
Shell Development Company, Emeryville, Calif.
Sheller Mfg. Co., Dryden Rubber Div., Chicago, Ill.
Sherwin-Williams Company, The, Cleveland, Ohio
Shwayder Bros., Inc., Denver, Colo.
Standard Oil Company (Indiana), Chicago, Ill.
Standard Oil Development Co., New York, N. Y.
Stauffer Chemical Company, New York, N. Y.
Stewart Die Casting, Chicago, Ill.
Sun Oil Company, Philadelphia, Pa.
Tranter Manufacturing, Inc., Lansing, Michigan
Unexcelled Chemical Corp., Cranbury, N. J.
Union Carbide & Carbon Corp., New York, N. Y.
United Carr-Fastener Corp., Cambridge, Mass.
United States Rubber Company, New York, N. Y.
Universal Match Corp., Ferguson, Mo.
Vitro Corporation of America, New York, N.Y.
Vulcan Copper & Supply Co., The, Cincinnati, Ohio.
Western Electrochemical Company, Henderson, Nev.
Witco Chemical Company, Chicago, Ill.
Wyandotte Chemicals Corp., Wyandotte, Mich.
Zaremba Company, Buffalo, N. Y.
Zenith Plastics Company, Gardena, Calif.

Companies listed in bold face type are Sustaining Members.

FOR 1955 IT'S

C L E V E L A N D

Plans for Next Annual Meeting of A. F. C. A. Already Well Advanced

GLENN A. HUTT

The 10th annual meeting of the A.F.C.A. will be held at the Hotel Cleveland, Cleveland, Ohio on June 16-17, 1955, with the Cleveland chapter of the Association in the role of host.

Mr. Glenn A. Hutt, vice-president of the Ferro Corporation in Cleveland and one of the vice-presidents of A.F.C.A., is chairman of the general committee on arrangements. Assisting him as deputy chairmen are Mr. Harry A. Wansker of the United Carr Fastener Corporation, Cambridge, Mass., A.F.C.A. vice-president for meetings, and Colonel Harry A. Kuhn, USA (Ret.), chemical consultant in Washington, D. C., a past president of the Association.

Mr. Hutt, in reporting on his plans at the annual mid-year meeting of the A.F.C.A. Board of Directors in New York on September 15, surprised the Board with the information that already the program for the Cleveland gathering has been outlined and indeed some parts of it have been definitely arranged.

Following a coffee-hour "get together" on the first day of the meeting it is planned that the group will proceed for a luncheon and demonstration at Nela Park, the General Electric Company's lamp manufacturing establishment on the outskirts of Cleveland. A feature of this event which the committee believes will be of special interest to women members and guests will be the display of lighting equipment for various decorative effects in home furnishing. Other events for the program in the way of entertainment which are under consideration are a fashion show and a card party for the ladies and a boat trip on Lake Erie for the entire group. Featuring the second day's program will be the symposium in the afternoon with a series of presentations on matters of military concern and a cocktail party and the annual banquet that evening. Speakers for these meetings have not yet been selected by the committee, but programs of outstanding interest and value are promised for each. It is understood the symposium will deal essentially with Chemical Corps items of materiel and equipment.

In accordance with the customary practice of the

Cleveland Chapter Officers, left to right: Robert R. Cutler, President; H. P. Connare, First Vice-President; Russell Lawson, Second Vice-President; Ray H. Armor, Secretary-Treasurer.

Association to call on some one of the three armed services each year to act as patron or host service, the Army will be looked to for that function at the Cleveland meeting. Accordingly, it is expected that the Chemical Corps of the Army will take an especially active part. In this connection, it is understood that plans are under way for the design and production of an entirely new set of exhibits of Chemical Corps materiel and activities, and it is hoped that the fabrication of these new displays will be completed in time for showing at the Cleveland gathering.

The Cleveland chapter of A.F.C.A. has looked forward for some time to having the Association in Cleveland for an annual meeting. The chapter was established early in 1947. Following organization 82 members were enrolled. The number has now grown to 162. The present officers of the Cleveland chapter, upon the members of which will fall much of the burden of arranging and carrying through the 1955 meeting, are: president, Mr. Robert R. Cutler, District Sales Manager, the H. K. Ferguson Company; first vice-president, Mr. H. P. Connare, Director of Personnel, the Ferro Corporation; second vice-president, Mr. Russell Lawson, Sales Manager, Monarch Aluminum Manufacturing Company; and secretary-treasurer, Mr. Ray H. Armor, Assistant Treasurer, Diamond Alkali Company. The growth of the Cleveland chapter might be considered as in line with the increasing importance of Cleveland as a chemical manufacturing center. This aspect of Cleveland's industrial development is emphasized in an article entitled "Choicest Customers, Nearest Neighbors," in the September 4 issue of "Chemical Week," reprinted in this issue of the Journal through the courtesy of the Editorial Director of "Chemical Week," Mr. Sidney D. Kirkpatrick, a director-at-large of A.F.C.A., and the publishers, the McGraw-Hill Publishing Company, Inc.

Both Mr. Wansker and Colonel Kuhn were members of the preliminary steering committee which met last summer in Cleveland with Mr. Hutt and other members of the Cleveland chapter to draw up organization plans for the annual meeting. The appointment of the general committee with Mr. Hutt as chairman resulted. Mr. Wansker states that the enthusiasm and interest which the Cleveland chapter has displayed give promise of an excellent program and attendance at the Cleveland gathering. Together with Mr. Hutt, Colonel Kuhn, and other members of the general committee he urges all members who possibly can to attend the Cleveland meeting this June, and to make appropriate notations on their date calendars—NOW.

MUSCLE SHOALS CHLORINE PLANT

Sale of the Government-surplus Muscle Shoals chlorine plant at Muscle Shoals, Alabama, to Diamond Alkali Company, Cleveland, Ohio, was announced by the Department of the Army on October 8.

The sale price was $15,127,000.

The Muscle Shoals chlorine plant was constructed for the Government in the period 1950 to 1952 to meet a critical shortage in chlorine. It was built with a rated capacity of approximately 225 tons of chlorine and 250 tons of caustic soda per day.

CHRISTMAS PARCELS

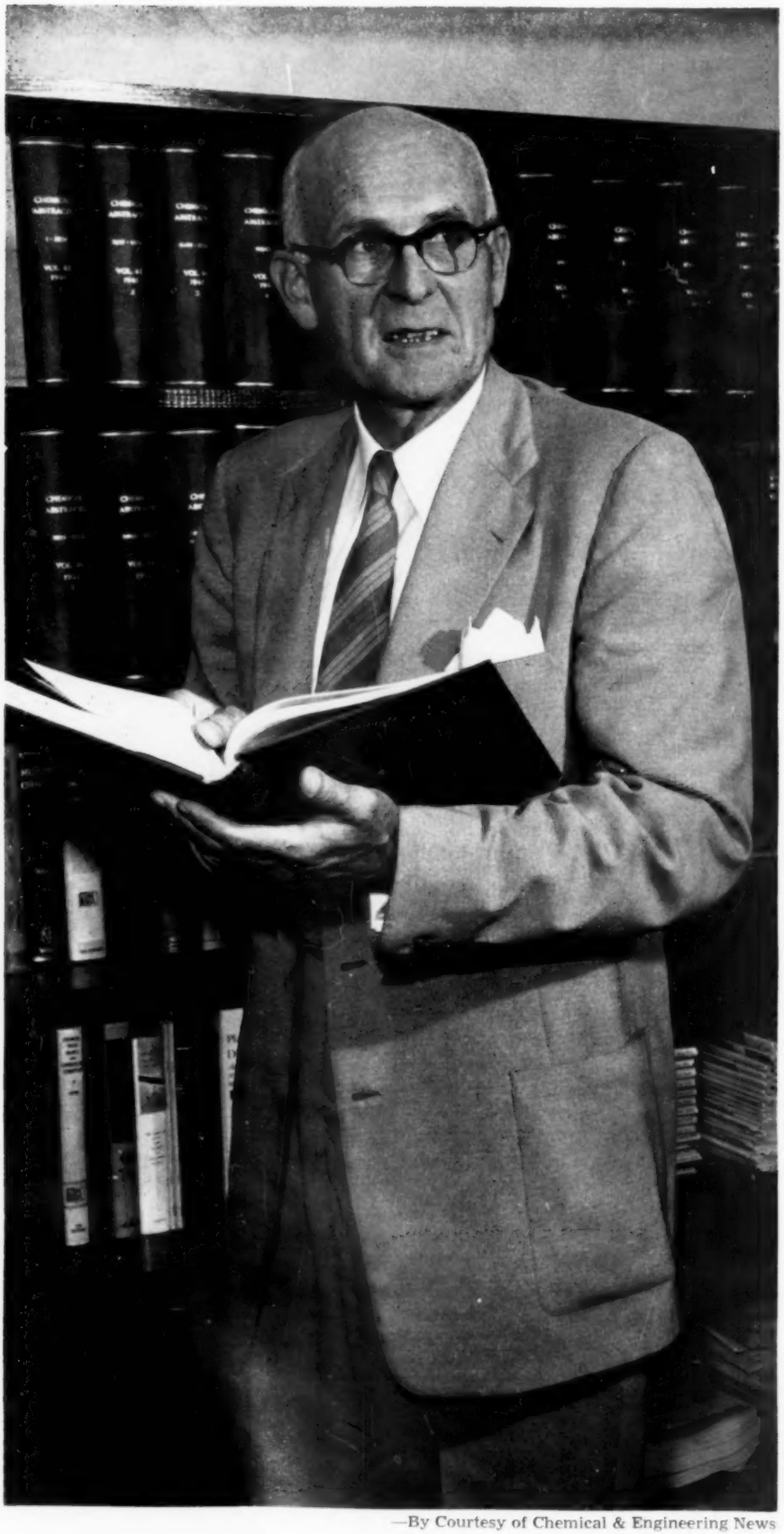
Christmas parcels for members of the Armed Forces overseas should be mailed between October 15 and November 15, the Department of Defense has announced.

Boxes for overseas must be of double-faced corrugated cardboard, strong wood, metal or fiberboard. Each box should be securely tied with strong cord, and loose flaps should be sealed with gummed tape. Boxes addressed to an APO or FPO should not exceed 70 pounds in weight and 100 inches in length and girth combined.

Air Parcel Post may not exceed two pounds in weight or 30 inches in length and girth combined.

CHIEF SCIENTIST, CHEMICAL CORPS

DR. PER K. FROLICH



—By Courtesy of Chemical & Engineering News

MUCH interest has been shown in chemical circles, both civil and military, in the appointment of Dr. Per K. Frolich to the top civilian scientific position of the Chemical Corps of the Army, announced late last August.

The job-title for this position, a new one, will place Dr. Frolich in the dual role of "Deputy for Scientific Activities and Chief Scientist, Chemical Corps."

Dr. Frolich is vice-president for scientific activities of the Chemical Division of the Merck and Company, Inc., Rahway, N. J. He is a past president of the American Chemical Society and since 1949 has been one of the Directors-at-Large of the A.F.C.-A. He is to assume his new duties in the office, in Washington, D. C., of Major General William M. Creasy, Chief Chemical Officer, Department of the Army, about December 1.

Dr. Frolich's outstanding position as a scientist, genial personality, and wide acquaintance constitute in themselves sufficient reason for the extensive interest shown in his appointment. However, in this case there is an additional factor of interest since Dr. Frolich's assignment, while not altogether new to the organization of the Chemical Corps, is considerably broader as to the responsibilities and administrative duties involved than the previous scientific position which carried the title of Senior Scientific Adviser. That position was established in the office of the Chief of the Chemical Corps after the war and it has been occupied by outstanding scientists, but for limited periods on a part-time or full-time basis. It is understood, however, that the newly created permanent position which Dr. Frolich is to occupy will give him broad administrative and control responsibilities in addition to his functions as scientific adviser. The wording of the official announcement by the Chemical Corps in this respect is as follows: "Dr. Frolich will furnish authoritative advice and counsel to General Creasy and members of his staff in the formulation, planning, reviewing, evaluation, and approval of the overall research and development program of the Chemical Corps. He will also have major authority and

responsibility for administering and controlling these programs."

To friends of Dr. Frolich who are familiar with his family background, and very possibly to Dr. Frolich himself, this new assignment, which places him definitely in the military establishment, is to be viewed as the more or less inevitable working of the Frolich family tradition. For Dr. Frolich, a native of Norway, comes from a long line of military ancestors. His records show that more than 300 years ago the progenitor of this Norwegian family came to Norway from Sweden. This ancestor, a medical man, served as a surgeon ("field amputator") in the Norwegian Army. His son entered the military service, became a lieutenant general and commanded the military forces in the northern part of the country. However, after four subsequent generations of Army officers, the family of Dr. Frolich's father frowned on his ambition to make the calvary his career, with the result that he compromised for architecture.

Dr. Frolich, son of the architect, was born in Kristiansand on June 29, 1899. He received a technical education in the Norway Institute of Technology and, after remaining there a year as a teacher, came to the United States on a fellowship-award to undertake graduate studies at the Massachusetts Institute of Technology. Continuing research work and teaching at MIT, he was made associate professor of chemical engineering in 1927.

In 1929 he joined the Standard Oil Development Company of New Jersey and in that year he also became a naturalized American citizen. During World War II Dr. Frolich served on the executive committee of the Chemical Division of the National Research Council. He was also professional consultant of the Office of Rubber Reserve, the Rubber Reserve Company, and the Office of the Rubber Director. He joined Merck & Company, Inc. in 1946.

Dr. Frolich holds honorary doctoral degrees from Rutgers and Lehigh universities. He has contributed some 60 papers to scientific publications covering work in electro-chemistry, high pressure gas reactions, and other fields, and he holds some 75 patents. In 1930 he was awarded the Grasselli Medal by the Society of Chemical Industry.

Among his extensive associations in the American Chemical Society Dr. Frolich has, since 1942, been a member of the Committee Advisory to the Chemical Corps.

Dr. Frolich is also a member of the American Institute of Chemical Engineers, the Society of Chemical Industry and is associated in advisory capacities with the Department of Chemical Engineering, Princeton University; Research Council of Rutgers University; and Department of Biology, Massachusetts Institute of Technology.

Dr. and Mrs. Frolich presently reside in Westfield, N. J. They have two daughters, one married who resides in Boston, and one a student at Mount Holyoke College.

COL. ROTHSCHILD HEADS CHEMICAL CORPS BOARD

Colonel Jacquard H. Rothschild, Regular Army officer of 28 years' service, is the newly appointed President of the Chemical Corps Board, stationed at Army Chemical Center, Md. He succeeds Colonel Leonard M. Johnson who retired last July.

A graduate of the United States Military Academy, class of 1930, Col. Rothschild was first commissioned in the Field Artillery. In 1937 he transferred to the Chemical Corps, and subsequently attended the Massachusetts Institute of Technology where he received a degree of M.S. in Chemical Engineering in 1940.

After leaving MIT, he served as executive officer of the Technical Division at the Army Chemical Center, and in 1941 he returned to MIT as commanding officer of the Chemical Warfare Service Development Laboratory there. For this service he was awarded the Legion of Merit.

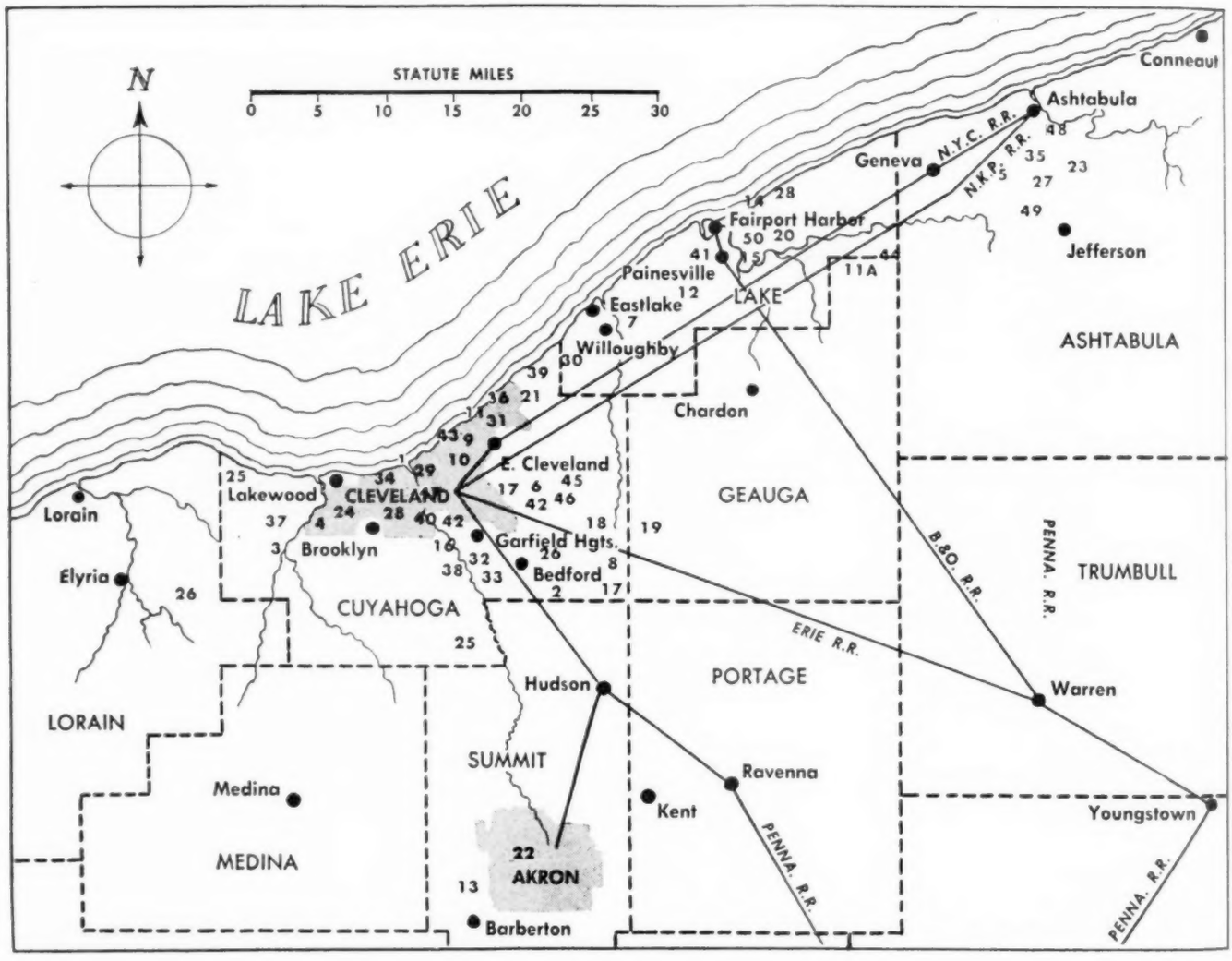
In 1944 Colonel Rothschild left MIT to take command of and train the newly activated 93rd Chemical Mortar Battalion. The battalion was in action in France and Germany, and for meritorious service during this assignment Col. Rothschild was awarded the Bronze Star Medal.

In 1945 he received promotion to the grade of Colonel and was appointed Chief of the Technical Division.

From 1948 to 1950 Col. Rothschild was stationed at the United States Military Academy at West Point as Assistant Professor of Chemistry, instructing in both chemistry and physics.

Col. Rothschild served 31 months in Japan as Far East Chemical Officer prior to his present assignment.

Cleveland, where A.F.C.A. is to hold its 10th annual meeting, June 16-17, 1955, is described as a city of growing chemical importance in this article reprinted by permission from the Sept. 4, 1954 issue of "Chemical Week", Copyright 1954, McGraw Hill Publishing Co., Inc.—Ed.



CHOICEST CUSTOMERS, NEAREST NEIGHBORS

It's not because of better mousetrap manufacturing, particularly, but the world is about to beat a big new pathway to Cleveland's door—and this is bringing no end of delight to the chemical process companies that are clustered in and around that lakeside city.

Already, Great Lakes shipping has helped build up a northeast Ohio chemical industry employing close to 20,000 persons along a 100-mile stretch on Lake Erie (*see map and key, above*). This convenient waterway not only brings in the chemical raw materials—dolomite, limestone, sulfur—but also has served to set up close-at-hand, big-time customers for the chemicals produced here: oil refineries, rubber companies, steel mills, glass factories, soap and detergent makers, plastic fabricators, and suppliers of agricultural chemicals.

That these industries have been good, steady customers is attested to by the fact that chemical producers in the Cleveland area have spent more than $200 million on new plants and equipment since the end of World War II; and another $65 million is being invested in this year's expansion projects. Among the latest to be announced: Barium & Chemicals, Inc., new research laboratory and additional production facilities, $3.6 million; Stauffer Chemical, increased production capacity so that perchloromethyl mercaptan can be offered in commercial quantities; U. S. Rubber's Naugatuck Chemical Div., doubling of production capacity for Marvinol vinyl resins.

And Next the Seaway: Now, on top of all this, appraisals of northeast Ohio industrial activity must take into account the St. Lawrence Seaway, to be built jointly by the U.S. and Canada, which in effect will make Cleveland an ocean shipping terminal by 1960 (*CW, May 22, p. 74*). Costs of hauling in raw materials and of distributing finished products will plummet. Already strategically located between this country's two biggest market areas

Key No.	Company	Products
1	Acorn Refining Co.	Paints
2	Allied Chemical & Dye Corp, General Chemical Div.	Sulfuric acid
3	American Agricultural Chemical Co.	Sulfuric acid
4	American Marietta Co.	Paints
5	Archer-Daniels Midland Co.	Linseed oil
6	Arco Co.	Automotive lacquers, enamels
7	Barium and Chemicals, Inc.	Barium compounds
8	Ben Venue Laboratories, Inc.	Pharmaceuticals
9	Braden Sutphin, Inc.	Printing ink
10	Brush Beryllium Co.	Beryllium compounds
11	Burdett Oxygen Co.	Gases
11A	Calhio Chemicals, Inc.	Insecticides
12	Clifton Products	Beryllium compounds
13	Columbia-Southern Chemical Corp. (Subsidiary of Pittsburgh Plate Glass Corporation)	Caustic soda, chlorine
14	Diamond Alkali Co.	Caustic soda, chromates, chlorine
15	Diamond Magnesium Co.	Metallic magnesium
16	E. I. du Pont de Nemours & Co., Grasselli Chemicals Dept.	Acids, agricultural chemicals, silicates, zinc salts
17	Ferro Corp.	Pigments, glazes, chemicals
18	Garland Corp.	Waterproofing, coatings
19	General Biochemicals, Inc.	Pharmaceuticals
20	General Chemical Co.	Sulfuric acid
21	General Electric Co., Chemical Products Div.	Krypton, neon, oxygen
22	General Foods Corp., Colonial Salt Div.	Salt
23	General Tire & Rubber Co.	Polyvinyl chloride
24	Glidden Co.	Paints, varnish, naval stores
25	B. F. Goodrich Co.	Vinyl chloride, plasticizers
26	Harshaw Chemical Co.	Fluorides, nickel salts, ceramic colors and finishes
27	Hooker Detrex Chemical Co.	Perchlorethylene, trichlorethylene
28	Industrial Rayon Corp.	Viscose rayon
29	Interchemical Corp.	Printing ink
30	Lubrizol Corp.	Lubricant additives
31	Masterole Co.	Pharmaceuticals
32	McGean Chemical Co.	Nickel salts
33	Benjamin Moore & Co.	Paints
34	National Carbon Co.	Electrodes, graphite equipment, batteries
35	National Distillers Products Corp.	Sodium, sodium peroxide, chlorine
36	Patterson Sargent Co.	Paints
37	Pittsburgh Plate Glass Co.	Paints
38	Reilly Tar & Chemical Co.	Coal tar derivatives
39	Sheffield Bronze Paint Corp.	Paints
40	Sherwin Williams Co. (4 plants)	Paints, varnishes, lacquers
41	A. E. Staley Mfg. Co.	Soya bean oils
42	Standard Oil Co.	Refinery products
43	State Chemical Mfg. Co.	Waxes, supplies
44	Stauffer Chemical Co.	Carbon bisulfide
45	Strong Cobb & Co.	Pharmaceuticals, vitamins
46	Tremco Manufacturing Co.	Paints, maintenance supplies
47	Tropical Paint & Oil Co.	Paints, roofing specialties
48	Union Carbide and Carbon Corp., Electro Metallurgical Co. and Linde Air Products Div.	Ferro alloys, calcium carbide, oxygen, argon
49	U. S. Government Carbide Plant (G. S. A.)	Not in use
50	U. S. Rubber Co., Naugatuck Chemical Div.	Vinyl chloride, resins

(The names of the American Steel & Wire Co., Cleveland, and the National Tube Company, Lorain, Ohio, both producers of Coal chemicals, should be added to this list, "Chemical Week" issue of October 2, page 6—Ed.)

(New York and Chicago), Cleveland is about to become a seaport with low-cost shipping routes to everywhere.

One direct effect of the Seaway, of course, will be to bolster the position of the oil, rubber and metal industries that buy much of the area's chemical output. This will mean a general burgeoning of the region's manufacturing and commercial economy. Charles Ewald, executive director of the Cleveland World Trade Assn., predicts that with favorable legislation and an aggressive sales program, the Seaway will bring the city at least $1 billion worth of foreign trade annually.

The Seaway also is expected to sow new seeds in the area's chemical garden. Foreign ores that are now transshipped can be carried right up to the plant site by ocean-going freighters. Among the types of chemical process plants that might then flourish at Cleveland: phosphorous chemicals, abrasives from bauxite, and electro-metals—especially chromium, manganese and titanium.

—Robert L. Plants

ASHTABULA'S HARBOR: Planned for this future seaport, big titanium shipments.

Rebman

Above, HARSHAW'S CLEVELAND PLANT: From East 97th Street, colors, pigments, and chemicals.

New Glamour Metal: Right now, titanium is the big eye-catcher of those prospective newcomers. Negotiations are nearly complete between the U.S. government and Union Carbide and Carbons' Electro Metallurgical Co., which plans to build a $30-million plant on a 100-acre site near Ashtabula to turn out titanium sponge metal at the rate of 10,000 tons/year.

Kennecott Copper Corp. also is known to be interested in the area as the location for a proposed titanium plant. The Seaway looms large in this scheme; it would enable Kennecott to ship in titanium slag from the plant it operates with New Jersey Zinc at Sorel, Quebec.

When these titanium plans are set, the area's chemical industry is in for another round of expansion. Though details of the Electro Met process haven't been published, it's believed to require large quantities of sodium and chlorine. National Distillers Products Corp.'s chlorine-metallic sodium plant at Ashtabula and Diamond Alkali's caustic-chlorine operation at Painesville are understood to be ready and willing to expand present facilities to meet the needs of Electro Met and any other future titanium producers.

Short Sales Trips: Selling chemicals to your next-door neighbor is the cornerstone of the chemical process industries in northeast Ohio. Around Ashtabula and Paines-

Rebman

At Left, DU PONT'S SULFURIC PLANT: For nearly 90 years, supplying acid to oil, steel firms.

Aerial Surveys, Inc.

Runyan

NAUGATUCK CHEMICAL, DIAMOND ALKALI: In chemical complex at Ashtabula, products travel door-to-door by pipeline.

ville, there's a chemical complex that presents one of the world's best examples of multi-company integrated operations. A growing list of products such as hydrogen chloride, hydrogen, chlorine and acetylene are being intershuttled in this area by pipeline.

Diamond Alkali, for instance, sells caustic soda and chlorine to Calhio Chemicals, which produces fungicides for the agricultural outlets. Stauffer Chemical delivers carbon bisulfide to Industrial Rayon Corp., which turns out rayon cord for the tire manufacturers at nearby Akron. National Distillers sends metallic sodium to Archer-Daniels-Midland, which uses it in making fatty alcohols for detergent makers.

There are still more links in this chain. With calcium carbide from Electro Met and hydrogen chloride from Diamond Alkali, Naugatuck Chemical produces polyvinyl chloride for plastic fabricators. Another supplier of that same material is General Tire's chemical plant, which gets its hydrogen chloride from Hooker-Detrex and its acetylene from Linde. In turn, Hooker-Detrex gets its chlorine from National Distillers and Linde uses calcium carbide from Electro Met in making acetylene. Linde also pipes acetylene to Hooker-Detrex which uses it to produce degreasing agents for metalworking industries. Oil refineries in the area get sulfuric acid from General Chemical and Grasselli Chemical plants.

Founded on Refining: It was this kind of an on-the-spot industrial market that brought the first important chemical plant to this area. That was back during the War Between the States, when John D. Rockefeller, Sr., began to refine petroleum at Cleveland—the birthplace of Standard Oil Co. In 1865, Eugene Grasselli started a sulfuric acid plant to supply the oil and steel companies in Ohio; his firm became a part of the Du Pont organization in 1928.

Pioneers in the movement that has made Cleveland a leading center of paint and varnish manufacture were Sherwin-Williams (1870) and the Glidden Co. (1875). Harshaw Chemical began production just before the turn of the century; and there are now more than 50 makers of coatings, pigments and related products in Cuyahoga County including Ferro Corp.,—a major producer of porcelain enamel frits.

Outside the city, the Painesville-Ashtabula vicinity was opened to the chemical industries by Diamond Alkali, which started producing soda ash for glass makers in 1912. That plant has been expanded manyfold since then, now produces caustic soda, chlorine, sodium bicarbonate, muriatic acid, chromates, coke by-products, and alkali specialties.

Rhyming Slogan: Biggest booster for this region is Cleveland Electric Illuminating Co., which for the past nine years has been plugging its "Best location in the nation" theme—with heavy emphasis on chemicals.

As to power supply, CEI has been expanding so that its present generating capacity—more than 1.5 million kw.—is nearly double the 1949 figure. Lake Erie constitutes a vast fresh water supply—of prime importance to chemical producers. Natural gas rates are higher than in Texas chemical centers, of course; but the Ohio Fuel Gas Co.—affiliated with the $600-million Columbia Gas System—appears to be in a position to furnish whatever quantities may be called for.

Formerly, CEI's "best location" slogan was based mostly on the fact that within 500 miles of Cleveland are 75% of U. S. industrial capacity and 57% of the population. Now that the slogan is taking on added meaning because of the Seaway, the Cleveland area seems destined to exert still greater drawing power in the competition to attract new chemical plants.

DETRICK REWARDED FOR SAFETY PROGRESS

For its achievements in operations safety in 1953, Camp Detrick, biological warfare research station of the Chemical Corps at Frederick, Md., received two awards this year: a bronze plaque presented last May by the Armed Forces Chemical Association and the Award of Honor of the National Safety Council presented at a seminar at Camp Detrick on July 9.

Behind these awards is the story of a vigilant and dynamic safety program for coping with the hazards of laboratory experiments involving the use of dangerous disease-causing organisms.

This program does not only involve the exercise of technical skills by laboratory workers and the routine practice of special safety procedures; it includes also continuing work for the development or improvement of special safety equipment.

Numerous devices and techniques for promotion of safety in this field of scientific research have been designed and developed at Detrick and have since been adopted for use in laboratories of many colleges and commercial institutions.

Exhibit At Scientists' Congress

An extensive exhibit of its safety procedures and equipment was made by Camp Detrick at the International Congress of Clinical Pathologists at the Shoreham, Washington, D. C., September 6-10. Interesting facts concerning this Detrick program were contained in an announcement about the exhibit made by Colonel John J. Hayes, Assistant Chief Chemical Officer for BW and Commander at Camp Detrick.

It appears that early in the 11-year history of Camp Detrick, Chemical Corps scientists ascertained that one of the main obstacles to laboratory safety was that many researchers were not aware that certain mechanically simple bacteriological tasks were dangerous.

Safety Award Ceremony at Camp Detrick—Maj. Gen. Charles E. Loucks (then Brig. Gen.), Deputy Chief Chemical Officer of the Army, hands National Safety Council Award of Honor plaque to Col. John J. Hayes, Camp Detrick Commander. Others in picture, left to right, Dr. Le Roy D. Fothergill, Scientific Adviser to Col. Hayes; Dr. John L. Schwab, Technical Director, and Dr. Arnold G. Wedum, Safety Director.

Detrick safety experts, however, have found that such simple procedures as removing cotton plugs from culture-containing test tubes, or pipetting cultures, can free dangerous organisms into the surrounding air.

A survey published in the American Journal of Public Health in 1951 revealed that 1342 persons in the United States had been infected with organisms they were studying in the laboratory. Thirty-nine died (none at Detrick). In 75 per cent of the 1342 cases, there was no known accident to account for the infection. Detrick scientists assume from this that the persons were infected while performing operations they thought were safe.

Danger in Opening Vials

An especially hazardous laboratory procedure which Detrick scientists have found a means to combat is the opening of vials containing infectious cultures in the powdered dry state. Sealed under high vacuum, the organisms literally explode into the air. The laboratory worker inhales some of the micro-organisms or they settle on his hands, face, or clothes. Whether or not he becomes ill depends upon the number of organisms, how infectious they are, whether he is immunized, and the general state of his health.

One of the best all around safety devices developed by Detrick is the bacteriological safety cabinet, very similar in design to the cabinet used by radioisotope workers. A scale model was included in the exhibit.

Long rubber gloves extend inside the air-tight cabinet. By putting his hands in the gloves, the worker is able to manipulate objects inside the cabinet. He sees through a glass panel in the top. A current of air sweeps bacterial aerosols (sprays of germs) away from him. The bacteria are filtered through a specially devised filter (another Detrick achievement) which prevents them from reaching the outside air. An attached autoclave for sterilizing infectious materials and an ultraviolet air lock completely isolates the cabinet's interior from outside air.

Among other safety devices displayed were: Pipetting devices for sucking toxic materials into glass tubes; protective clothing including a ventilated head hood; special air conditioned cages for infected animals with cage racks equipped with ultraviolet barriers to prevent cross-infection; special centrifuge safety cups; a leak-proof high speed blendor for homogenizing infectious materials and a slit type air sampler to detect bacteria in the atmosphere.

NEW HONORS FOR DR. ROGER ADAMS

—Fabian Bachrach

DR. ROGER ADAMS, on the occasion of his retirement as head of the Department of Chemistry and Chemical Engineering, University of Illinois, received the Meritorious Civilian Service Award for outstanding contribution to the national defense program. The certificate was presented to Dr. Adams by Major General Charles E. Loucks, Deputy Chief Chemical Officer, on September 3 during a two-day technical symposium at the University held in Dr. Adams' honor.

Dr. Adams' service to national defense in the chemical warfare field dates from 1917 in World War I when he joined the Research Section which was organized at the American University Station in Washington, D. C. He became the head of Organic Research Unit Number 2 Among accomplishments of this unit was the development of a new war gas called Adamsite, named after Dr. Adams. It was used in military operations in the war, and afterward was found to have considerable merit as a training agent and in controlling civil disturbances.

Beginning in 1940, Dr. Adams, as a member of the National Defense Research Council, headed a group which did important work on the synthesis of gasoline additives, development of protective ointments, and studies of toxicity and vesicant action. With the creation of the Office of Scientific Research and Development in 1941 he became one of its key members and had an important role in organizing effectively the work of the National Defense Research Council's Division 9 (Chemistry).

Dr. Adams participated extensively in Chemical Corps activities including the planning for the European invasion, civilian defense matters, screening of new compounds, development of decontamination processes, studies of incendiaries and healing of burns, the development of gas detection kits, and mask canisters.

In 1947 Dr. Adams was made Chairman of the Board of Directors of the American Chemical Society, and he was instrumental in revitalizing the Society's Committee Advisory to the Chemical Corps which had been inactive during the war period. In 1952 Dr. Adams was appointed Chairman of the Research Subcommittee of this Committee, which position he still holds. He made notable contributions to the development of methods for coordinating efforts of industry and the Chemical Corps and in improvement of research administration.

Dr. Adams has been the recipient of many honors for scientific achievements. He was awarded the Priestly Medal of the American Chemical Society. He also has received the Willar Gibbs Medal, the Nichols Medal, the Davy Medal of the Royal Society of London, and the Remsen Memorial Lecture Medal. He has received honorary degrees from Harvard University, his alma mater, Northwestern University, University of Rochester and the Polytechnic Institute of Brooklyn, University of Pennsylvania and Yale University. He is a member of the Society of Chemical Industry and the Philosophical Society. He is a Fellow of the American Academy and Honorary Fellow of the London Chemical Society and also of the Societe Chimique de France and is an Honorary Member of the Polish Chemical Society.

DRS. DILL AND GREENE PROMOTED

Dr. D. Bruce Dill, Scientific Director, Chemical Corps Medical Laboratory and Dr. L. Wilson Greene, Technical Director, Chemical Corps Chemical and Radiological Laboratories were recently promoted to the Civil Service rating of GS-17.

PETROCHEMICALS and Plastics

BUILDING BLOCKS IN NATIONAL DEFENSE

By

RAYMOND H. EWELL

Assistant Director for Program Analysis
National Science Foundation

Dr. Ewell, who has degrees from the University of Toledo, Purdue, and Princeton, was awarded the Medal of Merit for his outstanding work in the field of chemistry, including incendiary bombs and flame throwers, while associated with the National Defense Research Committee in World War II. As manager of the Chemical Economic Service, Stanford Research Institute, San Francisco, he contributed an article for the Journal in January 1953 on chemical raw materials entitled "Uncle Sam Gazes Into the Crystal Ball," which attracted wide attention. Dr. Ewell, on indefinite leave of absence from the Stanford Research Institute, joined the National Science Foundation about a year ago. The Foundation is a U. S. Government agency which was established in 1951.

(Adapted for the JOURNAL by the author from an address given by him before the Industrial College of the Armed Forces, Washington, D.C., 17 February 1954, and published with his permission and that of the commandant of the College.—Ed.)

The readers of the Armed Forces Chemical Journal are indeed a fortunate group of people—fortunate because they are connected, directly or indirectly, with America's most dynamic industry—*the chemical industry*. The chemical industry has the highest growth rate of any major industry in the United States. In fact, it has been the fastest growing U. S. industry for at least the past forty years. The chemical industry has for this very reason made the greatest percentage contribution of any industry to our increasing standard of living during the past few decades.

The chemical industry has been growing at an average rate of about 10 percent per year for the past fifty years. This is certainly a very high growth rate, compared with the average growth rate of all United States industry of about 3 percent per year. The chemical industry has consistently maintained a growth rate of over three times the average of all American industry. As a result of this high growth rate the chemical industry has grown in the past 15 years from a relatively small peripheral in-

Fig. 1

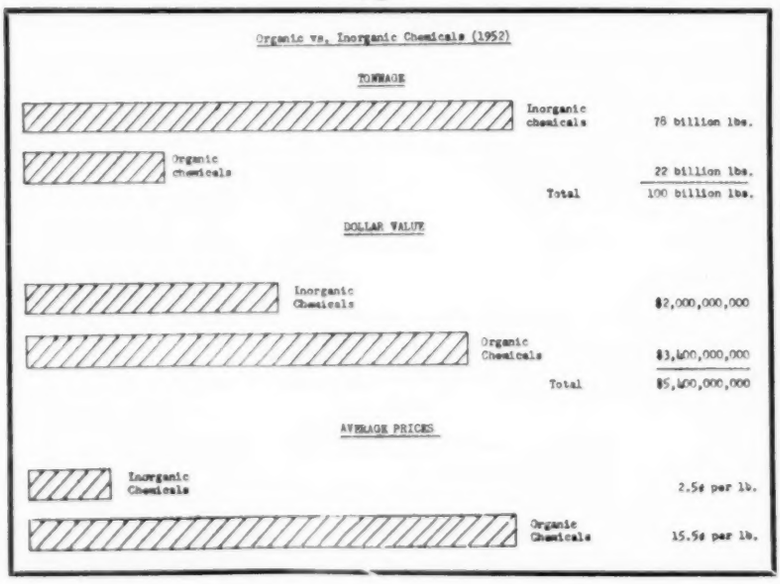
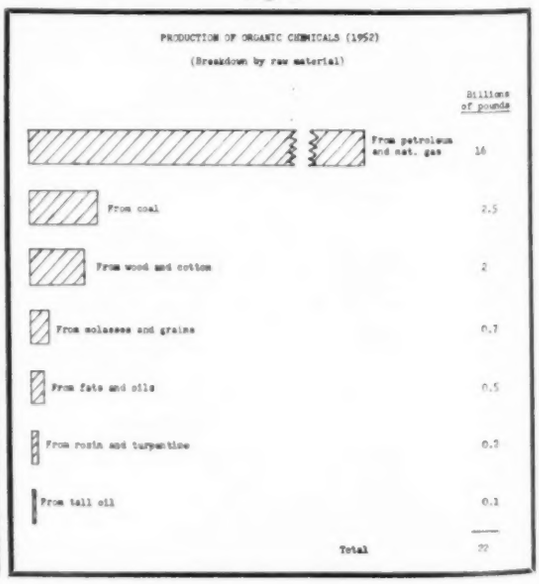


Fig. 2



dustry to become one of our really basic industries, a basic industry which produces things that we use, materials that go to make the clothes we wear, the furniture we sit in, the houses we live in, and thousands of other products that we use every day. Fifteen years ago the chemical industry was less than $2 billion a year—which classified it as a small industry—and it was peripheral because it mainly made process chemicals used by other industries. In 1939 the chemical industry did not make very many of the basic things that people use. Now it is a basic industry characterized by this very high growth rate.

One could generalize by saying that the chemical industry can make virtually any product that human wants might require. Moreover, it can make those products out of many alternative raw materials. The products of the chemical industry are today made principally from petroleum, natural gas, and coal. However, many of the products of the chemical industry, such as plastics and synthetic fibers, could if necessary, be made from sawdust. It might be more expensive to make plastics and synthetic fibers from sawdust instead of from petroleum, but the products would be the same thing.

The "chemical and allied products" industry, as defined by the Department of Commerce and other Government agencies, had sales in 1952 of around $19 billion per year. Out of this total, industrial chemicals, as produced by such companies as the Du Pont, Dow, Monsanto, American Cyanamid, etc., which we usually think of as "chemical companies," amount to about $9 billion. The "allied chemical products," such as pharmaceuticals, toilet preparations, soap, paint, and a number of other products, make up the other $10 billion. The "chemical and allied products" industry ranks as the sixth largest industry in the United States, and the industrial chemicals industry as a separate industry would rank as the eighth largest industry.

The products of the chemical industry may be divided into organic chemicals and inorganic chemicals. Of these two segments the organic chemicals are much larger in dollar volume, and moreover most of the organic chemicals are petrochemicals. Therefore, we can say that the petrochemical industry and the chemical industry are, *to a first approximation*, the same thing. Figure 1 gives a picture of the relative magnitudes of organic and inorganic chemicals. The tonnage of inorganic chemicals is larger than that of organic chemicals—78 million pounds vs. 22 billion pounds in 1952. However, dollar-wise organic chemicals are much larger since on the average they sell at much higher prices than inorganic chemicals do.

Just what are petrochemicals? Petrochemicals are chemical products which are made wholly or partly from petroleum or natural gas. They are mainly organic in nature, but some of the most important ones are inorganic. For instance, typical organic products made from petroleum are some of the new plastics such as polyethylene, polystyrene, and the polyvinyls. A typical inorganic petrochemical is ammonia. In fact most of the ammonia made in the United States today is made from natural gas, and is therefore a petrochemical.

Where is the petrochemical industry located? The petrochemical industry developed largely in Texas because that is where there is the most petroleum and natural gas; it is still largely located in Texas although it has been branching out. There are many large units of the petrochemical industry in Louisiana, Oklahoma, Arkansas, Kansas, California, and it is now moving into the Midwest and the Eastern seaboard. For instance, one of the largest recent petrochemical plants is in Tuscola, Illinois, built by the National Distillers Corporation. This is the largest synthetic alcohol plant in the world. Another recent petrochemical plant is that of the Sun Oil Company in Philadelphia. This is the largest benzene plant in the world.

Figure 2 shows what an overwhelming position petrochemicals occupy in the organic chemical field. The first bar shows the production of organic chemicals from petroleum and natural gas as 16 billions pounds in 1952, out of a total of 22 billion pounds of organic chemicals. A much smaller amount is made from coal, and still smaller amounts from wood, cotton, carbohydrates, fats and oils, rosin, turpentine, and tall oil. These chemicals comprise, with some minor exceptions, all the organic chemicals produced by the chemical industry.

Figure 3 shows the growth and production of three types of chemical products from petroleum and natural gas. Aliphatics, open chain carbon compounds, comprise the largest and most rapidly growing group. Aromatic chemicals are fairly new in the petrochemical game but

Fig. 3

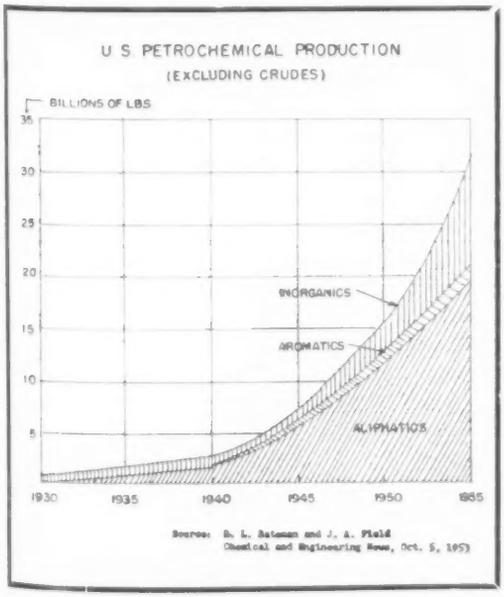


Fig. 4

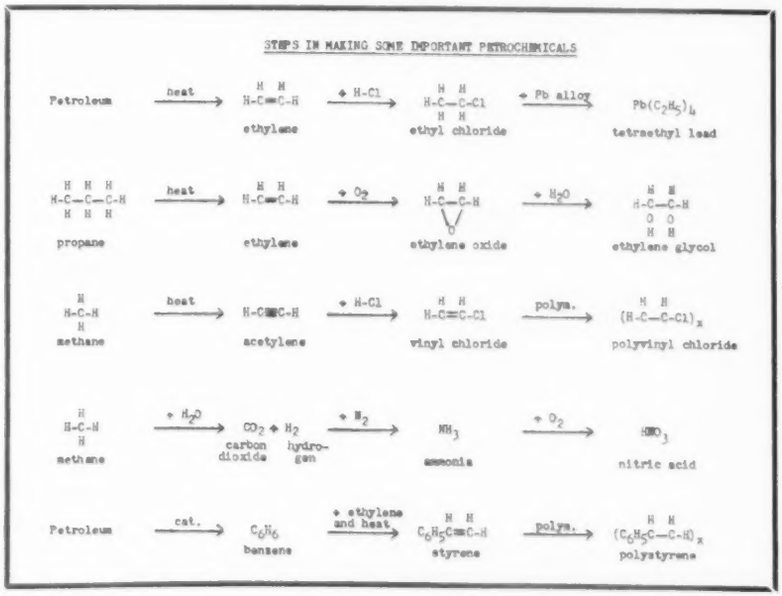
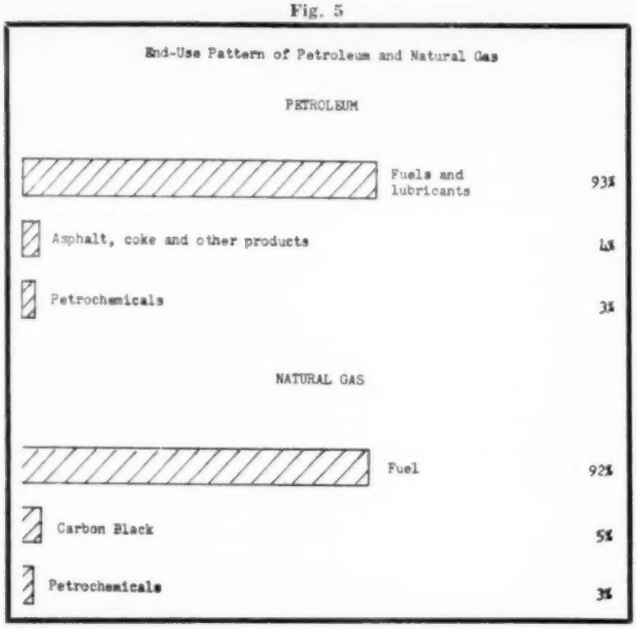


Fig. 5



they also are increasing fairly rapidly. Inorganics are growing rapidly, too, particularly ammonia.

Figure 4 shows a few examples of specific petrochemical processes. The series of reactions shown in Figure 4 show how petroleum or natural gas lead to such important products as tetraethyl lead, ethylene glycol, polyvinyl chloride, polystyrene and nitric acid. In order to convert petroleum and natural gas to these useful end-products it is necessary to use heat, pressure, catalysts and various reactants such as water, oxygen, chlorine, hydrochloric acid, etc. These are just a very few examples of thousands of chemical products made from petroleum and natural gas. Petrochemicals are principally used for civilian purposes, but a great many of them, in fact the large majority of them, also have important military applications.

Now that the petrochemical industry has become so important to the country, what is the situation in raw materials with regard to making petrochemicals? Do we have plenty of raw materials? Figure 5 shows that of all the petroleum consumed not over 3 percent is used to make petrochemicals (maybe only 2 percent; it is hard to estimate exactly). Two or three percent of all petroleum is used to make petrochemicals; 93 percent is used to make fuels and lubricants. The conclusion to be drawn from this is that there is plenty of room for expansion in the production of petrochemicals from petroleum. If it ever gets a lot bigger and we have to start cutting down on the petroleum available for fuels, there will, of course, be some economic consequences.

With natural gas the picture is pretty much the same. It is used mostly for fuel—space heating and other types of fuel uses. A significant amount is used to make carbon black. Something on the order of 3 percent is used to make petrochemicals. These percentages on both petroleum and natural gas are increasing rather rapidly because the production of petrochemical is increasing much faster than either the production of petroleum or natural gas.

What are petrochemicals used for? Figure 6 gives a breakdown of end-uses of petrochemicals on a rather broad basis. Rubber is the largest single user of petrochemicals, mainly synthetic rubber, but also there would be various rubber-processing chemicals that are used to make rubber products. Automotive and aviation together is the second largest use—for instance, tetraethyl lead and glycol antifreeze would be two big items in here, although there would be many others. Next are synthetic fibers—nylon, orlon, dacron, acrilan and still

Fig. 6

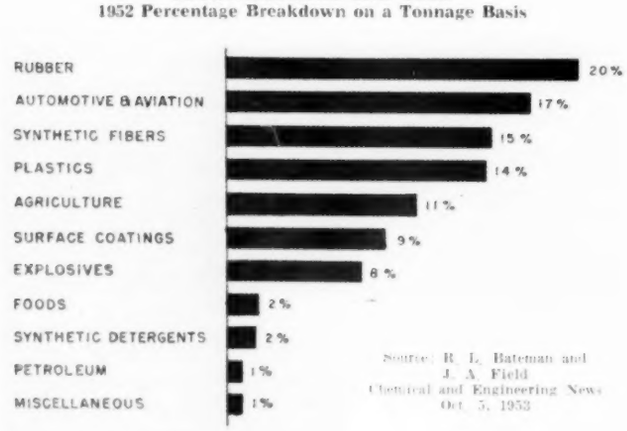
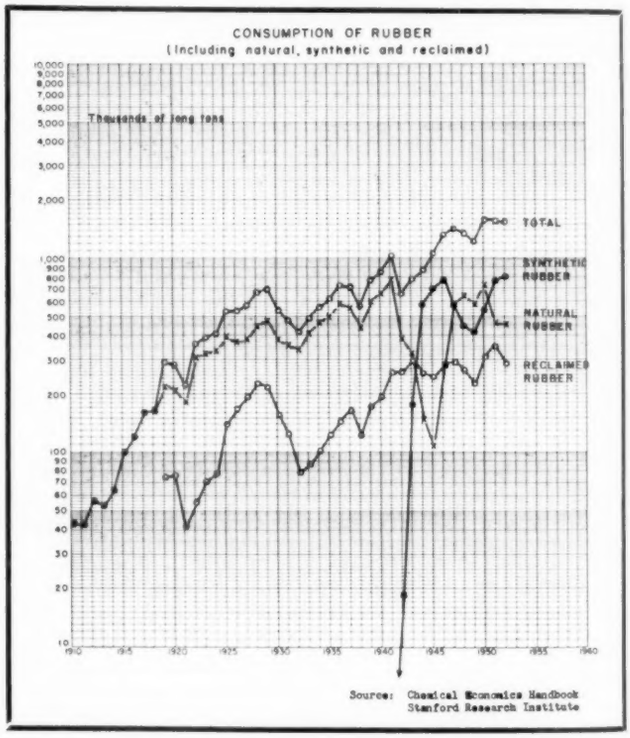


Fig. 7



others on the verge of coming into the market. Fifteen percent of all petrochemicals goes into synthetic fibers; 14 percent into plastics; 11 percent into agriculture (mainly ammonia for fertilizers); 9 percent into surface coatings; 8 percent into explosives. This is where the petrochemicals go.

Now before turning to plastics, which is one of the major petrochemicals and deserves special consideration because of its growing importance, I wanted to mention very briefly rubber and fibers, two other important petrochemical products. Figure 7 gives in a nutshell the impact of synthetic rubber on the rubber situation. Synthetic rubber is exclusively a petrochemical product. Note that this is a semilogarithmic graph, running from 10,000 tons to 10 million tons.

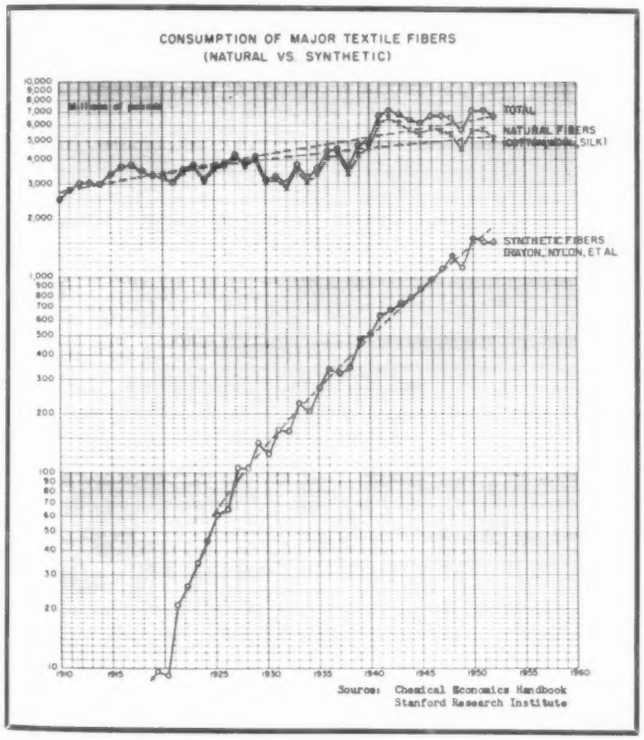
Natural rubber was our only source of new rubber until 1942; then natural rubber declined very rapidly as

a source of rubber. Synthetic rubber came into the breach first in 1942, more in 1943, 1944, 1945, 1946—the peak was in 1946 when synthetic rubber was most of the rubber consumed in the United States. Then in the postwar period, natural rubber came back strong again and surpassed synthetic rubber. With the advent of the Korean war, natural rubber went down again and synthetic rubber went ahead and will probably exceed natural rubber from now on.

Figure 8 gives a similar picture on synthetic and natural fibers. In 1920 natural fibers were predominant, in fact synthetic fibers were nearly non-existent. Synthetic fibers—rayon, acetate, nylon, and more recently orlon, dacron, acrilan—have been increasing rapidly so that in 1952 synthetic fibers were 1.5 billion pounds or 23 percent of total fiber consumption. Synthetic fibers will continue to gain on natural fibers and should surpass natural fibers sometime between 1965 and 1975.

Now let's look at plastics—Mr. Big in the chemical industry. Figures 9, 10 and 11 show the very high growth rate of plastics, which has averaged over 20 percent per year during the past 30 years. Figure 9 shows that among

Fig. 8



the groups of plastics, thermoplastics have the highest growth rate and cellulose plastics the lowest. In 1939 thermoplastics was the smallest of the four principal groups, but by 1944 it was first.

Figure 10 shows that among the thermoplastics, polystyrene and polyvinyls are fighting it out for first place. Both have high growth ratios, but polystyrene has the higher growth rate and should forge ahead of polyvinyls. However, the polyethylene is the fastest growing of all plastics and it should be the first plastic to reach one billion pounds, probably before 1960.

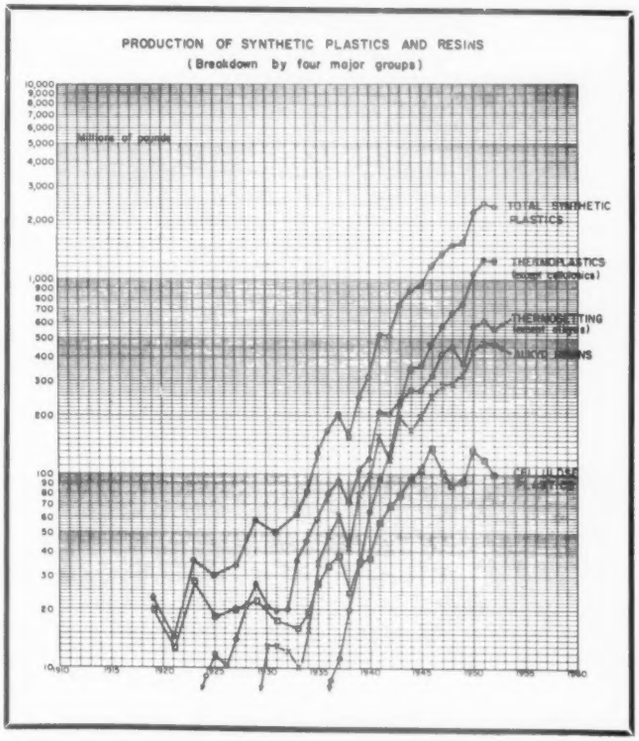
Figure 11 shows that among the thermosetting resins, melamine resins, have a higher growth rate than urea resins, which in turn have a higher growth rate than phenolic resins. All three of these resins have many peacetime and wartime applications. Polyester resins (included in "All Other") are growing rapidly and have many military applications.

Plastics have grown during the past 30 years largely by replacing older, previously-used materials. In almost any use of plastics you can think of—plastic radio cabinets, plastic raincoats, plastic dishes, plastic bottles, plastic shoe soles, plastic wire covering—plastics have replaced some other structural material. The areas of competition of plastics are illustrated in the following table:

Areas of competition of synthetic plastics

Rigid plastics		
Polystyrene		Steel
Polyvinyls		Cast iron
Acrylics		Wood
Nylon		Copper and brass
Phenolics		Zinc alloys
Urea-formaldehyde	replace	Nickel and monel
Melamine-formaldehyde		Aluminum
Polyesters		Magnesium
Cellulose esters & ethers		Glass
		Ceramics
Nonrigid plastics		
Polyethylene		Rubber
Polyvinyls		Leather
Cellophane	replace	Textiles
Cellulose esters & ethers		Paper
Mylar		Metal foils and sheets
Coating plastics		
Alkyds		
Rosin esters		
Urea-formaldehyde		
Melamine-formaldehyde		Natural resins
Polyvinyls		Shellac
Polystyrene and copolymers	replace	Drying oils
Coumarone-indene		Tin (in coatings)
Cellulose esters and ethers		
Styrene copolymers		
Silicones		
Epoxies		

Fig. 9



The possibility of replacing metals, wood, rubber, leather, etc., by plastics has many important implications in both war and peace. All the heavy metals—iron, copper, lead, zinc, tin, nickel—are getting harder to extract from the earth and hence higher in price. On the other hand, plastics are made from raw materials which are very plentiful, even if not inexhaustible.

One of the most interesting plastics from the standpoint of replacing metals is nylon. Nylon is probably the nearest synthetic substitute for metal. Brass gears, for example, can be replaced by nylon gears. Nylon can be molded to very close tolerances, is very strong and has a valuable self-lubricating property. Molded nylon plastic is now probably 10 million pounds per year and growing rapidly.

(Continued on page 20)

Fig. 10

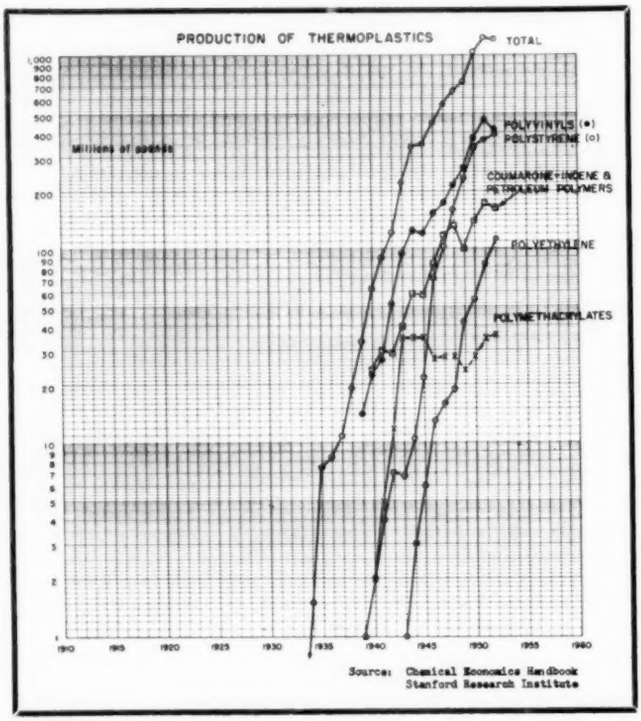


Fig. 11

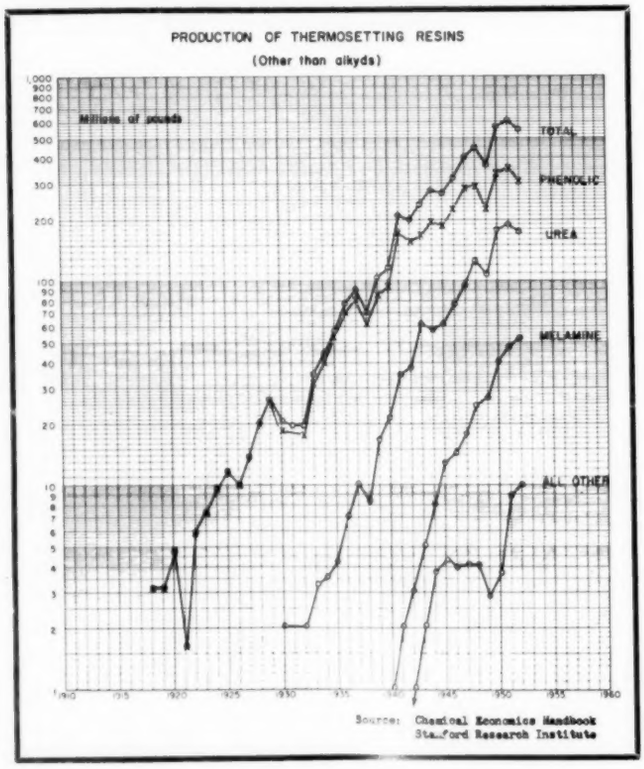


Fig. 12

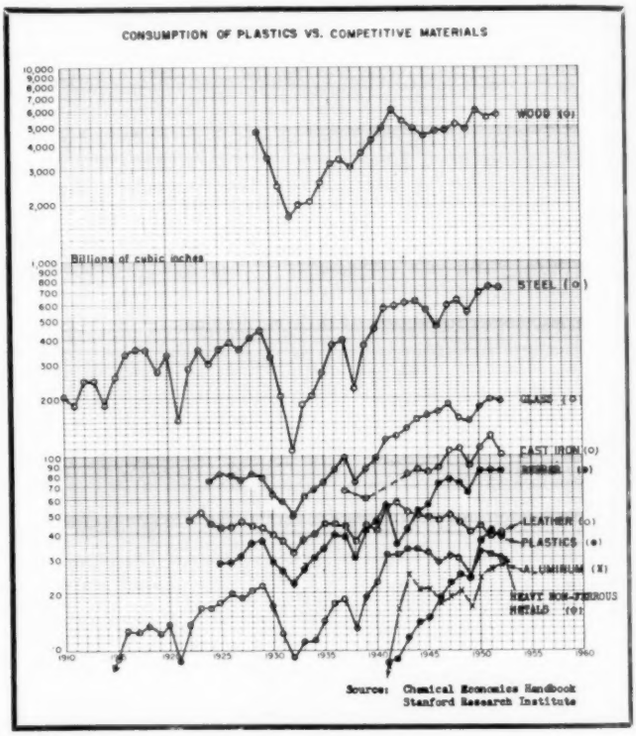
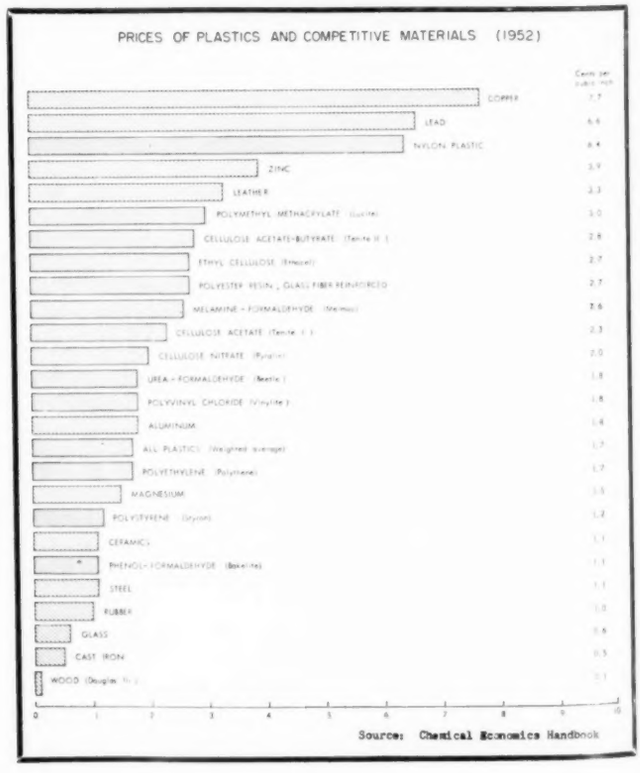


Fig. 13



NOW! dieldrin for HOUSEHOLD PESTS!

Label approval just granted for all these pests!

ROACHES • ANTS • TICKS

SILVERFISH • MUD DAUBERS

PAPER NEST WASPS

CARPET BEETLES

Dieldrin, one of the most powerful farm insecticides, is now available for use in the household. The recently granted approval is a testimonial to the safety record established by 4 years' use of dieldrin.

Insecticide manufacturers now have an opportunity to market formulations of dieldrin for household use in three recommended forms:

(1) As a 1% dieldrin dust

(2) As a 0.5% dieldrin solution

(3) As an emulsible concentrate containing 1.5 pounds of dieldrin per gallon, to be diluted by the customer according to directions on the label.

With this new label acceptance, exterminators and pest control operators can greatly expand their usage of dieldrin.

SHELL CHEMICAL CORPORATION

AGRICULTURAL CHEMICALS DIVISION

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FARMERS WARNED OF BIOLOGICAL WARFARE

The Federal Civil Defense Administration has issued a warning to America's farmers that they are vulnerable to biological warfare attack by enemy agents or airplanes carrying disease-laden mists and destructive chemicals.

The warning is contained in a newly-published FCDA handbook telling them how to detect and fight such attacks against their animals or crops. The handbook, announced in a press release dated October 17, is entitled "What the Farmer Should Know about Biological Warfare." It is being distributed to Civil Defense officials and national agricultural organizations. Copies are on sale at 15 cents each by the Superintendent of Documents, Washington 25, D. C.

In the publication, FCDA calls for an unending alertness by farmers to detect and report immediately to county agents or state livestock veterinary officials, any sign of unusual crop or animal diseases and any increase in native diseases. Ten precautions are listed, as follows:

1. Take normal sanitation measures to minimize disease spread.
2. Check animals regularly, for early discovery and prompt reporting of disease.
3. Isolate all sick stock. Isolate all new stock long enough to be sure they are not disease carriers.
4. Report immediately to veterinarian or state livestock sanitary official any increase in native diseases and the appearance of unusual diseases in livestock.
5. Follow approved vaccination practices for disease problems.
6. Dispose carefully of wastes and discharges of sick animals.
8. Cooperate with plant disease control officials.
9. Report immediately to county agent any crop damage from unfamiliar disease or insect.
10. Send insects or samples of diseased plants to county agent only, unless instructed otherwise by responsible agricultural authorities.

The FCDA release states the President recently approved a delegation of authority by Federal Civil Defense Administrator Val Peterson, making the Secretary of Agriculture responsible for combating biological and chemical warfare against animals or crops.

The Department of Agriculture has protection services now existing, such as inspection and border quarantine, to help carry out this responsibility with the cooperation of the Public Health Service, Bureau of Customs, and the Immigration and Naturalization Service. This protective system is further back-stopped by state cooperation and is organized for quick response in case of emergency.

CD OPERATIONS COURSE

A course in civil defense operations has been added to the curriculum of the Staff College, National Civil Defense Training Center, Olney, Md. The course is intended to give civil defense officials both theory and practical work in operations under assumed attack conditions. It reviews civil defense urban analysis, which provides the tools for realistic civil defense planning, and tells how to develop operational plans.

The operations course is an addition to the civil defense administration course previously offered by the CD training center. Actual or prospective CD officials may attend either course.

PETROCHEMICALS & PLASTICS

(Continued from page 18)

Figure 12 points up the competition between plastics and other materials in a more quantitative fashion. Plastics is now in sixth place as a structural material on a volume basis, being exceeded only by wood, steel, glass, cast iron, and rubber. The plastics data given in Figure 12 include only the rigid and nonrigid plastics and exclude the coating resins. The high growth rate of plastics seems almost certain to put plastics ahead of cast iron and rubber in 10-15 years and ahead of glass in 15-20 years. If and when these forecasts come to pass, plastics would then be exceeded only by wood and steel as a structural material. Aluminum is growing very rapidly, too, but it seems unlikely that aluminum will catch up with plastics (on a volume basis) in the foreseeable future. Figure 13 illustrates the competitive situation among these materials price-wise. The data in Figure 13 are on a price per unit volume basis. Of the materials given in Figure 13, copper is the most expensive at 7.7 cents per cubic inch, followed closely by lead and nylon. Brass would be a little cheaper than nylon since it is an alloy of copper and zinc. Then come zinc, leather, and a long list of plastics. The average of all plastics is 1.7 cents per inch, falling between aluminum and magnesium. At the bottom of the list is wood, the cheapest of all structural materials at 0.1 cent per cubic inch. This price relationship points up one of the fastest growing uses of plastics, namely, combinations with wood such as plywood and hardboard, in which a plastic gives wood better properties or upgrades waste wood.

CHEMICAL CORPS BRIEFS

COLONEL PYUEN HONORED

SENDAI, JAPAN, (XVI Corps) . . . Col. Pyueng S. Pyuen, who has served as Chemical Officer, Hqs. XVI Corps, since June 1953, has been assigned to the U. S. Army Chemical Corps Materiel Command, Baltimore, Md. A retreat review was held in his honor at Camp Sendai, Japan, on May 13. In picture Col. Pyuen is the second from the left.

Upon his departure Col. Pyuen was given a letter of appreciation from Major General A. D. Mead, XVI Corps Commander. Lt. Col. Francis M. Finley, who was formerly Chemical Adviser of the 1st ROK Corps in Korea, has been assigned to the XVI Corps to replace Col. Pyuen.

BUILDING NAMED FOR COL. STARK

A building at the Army Chemical Center formerly used for a service club has now been set aside for various post social gatherings including Boy and Girl Scout meetings and has been named "Stark Hall" in honor of Lt. Col. Edgar D. Stark who as commander of the 3rd Chemical Mortar Battalion was killed in action in the Italian campaign in World War II.

VETERAN OF BATAAN DEATH MARCH

First Lieutenant James Thomas Huxtable, veteran of the battles of Bataan and Corregidor, survivor of the Bataan Death March and three and a half years as a prisoner of war of the Japanese, is the newly appointed Disbursing Officer at Pine Bluff Arsenal, Arkansas. Lt. Huxtable, following his liberation, enlisted in the Finance Corps as a Master Sergeant in 1946, attended Finance School and was commissioned in the Finance Corps in November, 1948.

(Continued on page 40)

IN TOP ROTC AND CHEMICAL BRACKETS

Members have indicated desire to know more about the promising young men who receive the Association's R.O.T.C., medal and scroll for military and scholastic standing. Herewith brief sketches of twelve of the twenty-four juniors enrolled in Army, Navy or Air Force R.O.T.C., and majoring in chemistry or chemical engineering, selected by their institutions last spring for the A.F.C.A. award. Similar information about the others in this group of award winners will appear in an early issue.

JOHN EDWARD KEHOE, a Distinguished Military Cadet at Wake Forest College, Wake Forest, N. C., is majoring in biology and chemistry. He is a member of Alpha Epsilon Delta, Gamma Sigma Epsilon, the Cadet Officer Club, is on the staff of "The Student" and belongs to the College Little Theater Group. He attended the Chemical Corps ROTC summer camp at Fort McClellan this summer. Cadet Kehoe was graduated from Orlando High School, Orlando, Florida in 1951. He previously attended Gordon Military Institute at Barnesville, Georgia. Cadet Kehoe was employed in Miami for more than a year prior to enrolling at Wake Forest College.

JOHN D. WOOLEDGE, ROTC cadet at Purdue University, majoring in chemical engineering, was born at Evanston, Ill., in 1933 and now resides at Bloomington, Ill. He says: "I have always been interested in science and mathematics. Chemical engineering seems to have the best balance of these. When I finish I would like to go into development and design such as pilot plant work." Cadet Wooledge is married, excels in swimming and has two varsity letters. He was elected to the Pershing Rifles and the Junior-Senior Military Honorary—Purdue Order of Military Merit. He is a member of various honorary fraternities, including Omega Chi Epsilon.

ALVIN T. MAJOR, JR., ROTC cadet at the University of Delaware, majoring in chemical engineering, was born at Denton, Md., in 1932. He has shown outstanding aptitude for military science studies, having received no less than "A" for six semesters. This summer he attended the General Military Science ROTC Camp at Fort Bragg, N. C., and was designated as a potential Distinguished Military Student. In addition to ROTC, he is a corporal in the 763rd FA Battalion (Rocket) USAR. He is a member of the Theta Chi fraternity; Tau Beta Phi, honorary society; Pi Mu Epsilon, mathematics honorary society; Alpha Chi Sigma, chemical society; and the American Institute of Chemical Engineers.

ERWINE THEODORE BUCKENMAIER, JR., NROTC midshipman at Cornell University on a NROTC scholarship, was born in Oceanside, New York, in 1933. He attended Baldwin High School, where he participated in many athletic activities and served in a leadership capacity in numerous social, scholastic, and service organizations. He has two additional New York State scholarships, one for tuition and one for cash. University activities include membership in Phi Gamma Delta Fraternity and Scabbard and Blade Military Honorary Society. He was member of the Freshman Crew. He has served on various committees at Cornell.

JAMES GRAY UP de GRAFF, ROTC cadet at the University of California, Los Angeles, majoring in chemistry, is 20 years of age and resides at 700 Sarborne Rd., Los Angeles. He attended Hotchkiss School, Lakeville, Conn., for four years. He plans on a career in medicine; hopes to continue studies after taking a degree at U.C.L.A. His plans for military service are to obtain a commission in the Medical Corps but if called to service before entering medical school would seek to join the Chemical Corps. He feels that should his medical ambition not materialize his chemistry training will provide excellent opportunities. Cadet Up de Graff is a member of Phi Kappa Psi fraternity.

GERALD LEO GLAHN, NROTC midshipman at University of Oklahoma, was born in Enid, Oklahoma, in 1932. He was outstanding NROTC freshman in scholarship and a member of Freshman Crew. He was named by Pe-et, honorary senior organization, as one of 25 top sophomore men in scholarship, and in his junior year was selected as "B.M.O.C." (Big man on campus). Midshipman Glahn is member of Tau Beta Pi, Sigma Tau, and Theta Kappa Phi. He is a student affiliate of American Institute of Chemical Engineers.

ROBERT L. McBRAYER is an NROTC midshipman at University of Colorado, majoring in chemical engineering. He was born in Denver in 1933. He says, "I selected the chemical field for a career because it is growing and is the backbone of American industry and progress—many opportunities are open to get ahead." Midshipman McBrayer is a member of the Viking Club, the Sock and Buskin, the Star and Sextant (NROTC Honorary), and is vice-president of the student chapter of American Institute of Chemical Engineers.

CHARLES A. STICKELS, NROTC midshipman at University of Michigan, is on a combined degree program—chemical and metallurgical engineering. He was born in Detroit in 1933. He says, "The rapid expansion of the U. S. chemical industry in recent years seemed to indicate to me that this field offered more opportunity for the young engineer than any other. Besides this, I have always found my chemistry courses interesting and this certainly was an incentive." Midshipman Stickles' University activities include Editor-in-chief, Michigan Technic, engineering magazine; Vice-President Student Chapter of American Institute of Chemical Engineers; member of Tau Beta Pi and Triangles Honorary Society.

GORDON ELLSWORTH HARTZELL, AF ROTC cadet, Ohio University, Athens, Ohio, was born in Lodi, Ohio, on 28 July 1933. In high school there he engaged in a number of musical activities, and was also prominent in the dramatic club. He enrolled at Ohio University in 1951 to specialize in chemistry. His college honors and activities have included membership in the Phi Beta Kappa, in recognition of scholastic attainment; Phi Eta Sigma, honorary scholarship fraternity; Sigma Theta Epsilon, religious society; Der Deutsche Verein society interested in the promotion of the German language; and the Chemical Society. He has been president of Arnold Air Society, honorary organization for advanced AF ROTC students. He was student assistant in chemistry, appointed by the University, during both semesters of 1952-53. He is particularly interested in industrial chemistry. His hobbies are photography, bowling, golf, baseball, and basketball.

JEAN H. FUTRELL, AF ROTC cadet at Louisiana Polytechnic Institute, Ruston, La., is majoring in chemical engineering. He was born in Louisiana in 1933. He states: "I first became interested in chemistry at the age of seven when my father bought me a chemistry set . . . I should like to make petro-chemical research my career . . . help translate basic research into applied research. For that one needs a Ph.D. in chemistry and that is my present objective in life." Air Force Cadet Futrell was high school valedictorian and winner of Bausch & Lomb science award. He was student speaker at the Louisiana Engineering Society convention this year; won the 1954 American Institute of Chemical Engineers Award; has worked two summers in research department of Phillips Petroleum Co., Bartlesville, Okla.; is member of A.C.S. and various other professional societies.

JOHN R. MEYER, AF ROTC cadet at University of Wisconsin, was born in Milwaukee in 1933. He attended high school at Eau Claire and it was while there that he became interested in chemical engineering as a career as the result of his studies in preparing a term paper on the subject. Air Cadet Meyer, with three years undergraduate work behind him, worked this summer at the silicone plant of General Electric Company. After graduation he hopes to continue studies for an advanced degree. Meyer is a member of Sigma Alpha Epsilon, social fraternity; member of the American Institute of Chemical Engineers, and Tau Beta Pi, honorary engineering fraternity. He is active in various campus committees.

ROYAL G. ALBRIDGE is an AF ROTC cadet, Ohio State University, Columbus, Ohio. Born at Lima, Ohio, on January 20, 1933, he attended Lima South High School where he engaged in various athletic activities; was co-captain of football team and captain of basketball team. He enrolled at Ohio State University in the College of Arts and Sciences, and is majoring in chemistry. His university activities include membership in the Student Senate, Civitas, and Council on Student Affairs. In addition to the award of the AFCA medal, he was one of eight this year to receive the senior year scholarship award for outstanding chemistry, engineering, and physical science juniors throughout the nation, granted by the Atlas Powder Company, Wilmington, Delaware.

YELLOW FEVER IN MIDDLE AMERICA

By NORMAN W. ELTON
Chemical Corps Medical Laboratories
Army Chemical Center, Maryland

SINCE NOVEMBER 1948 a wave of sylvan (jungle) yellow fever has been moving progressively from eastern Panama toward Mexico and has already reached the northern coast of Honduras, where, in its advance toward Guatemala, its main axis must pass through a strip of coastal rain-forest 25 miles long and averaging about 5 miles in width, backed by mountains from 5000-7000 feet in elevation, and constituting a natural terrain funnel in the vicinity of La Ceiba. It is not know if sufficient forest still exists in the narrow portions of this strip to transmit the wave, since agricultural clearing may have progressed to a degree adequate to provide a natural barrier there, but events now in progress will resolve this question very soon, for it has been reported (May 1954) that monkeys are dying not only at Durango in the lower Aguan Valley about 15 miles southeast of Trujillo, 70 miles east of La Ceiba, but also in the vicinity of Yaruca in the upper Cangrejal Valley only 15 miles southeast of La Ceiba itself. Histologic examination of the livers of these monkeys would determine if the epizoötic was due to yellow fever, and if this proved true, the episodes would indicate that the spearhead of the wave has already reached the critical zone.

If the wave passes through this region, as it may already have done, then in due time (probably July 1955) northern Guatemala will become involved and the wave front will expand throughout the peninsula of Yucatan in ever-widening circles, striking the Gulf Coast of Mexico over a wide arc, whence it will continue moving northward in Yucatan and westward toward Vera Cruz.

When the Gulf Coast of Mexico becomes an epidemic center, precautionary measures involving control of the movement of human carriers by coastal shipping and by fishing boats whose crews contact the mainland of Mexico will be necessary to prevent the possible seeding of the *Aëdes aegypti* mosquitoes of Gulf ports in both Mexico and the United States unless adequate *aegypti* eradication programs have previously been completed.

The chronological sequence of events preceding this current situation is presented on the maps shown as Figures 1 and 2.

The Nature of Jungle Yellow Fever

Guthrie (12) has aptly stated that wherever the Spaniards went in the New World, the "Jaundiced Hand-Maiden of Death" awaited their arrival. Later, yellow fever became the scourge of the Atlantic from Boston to Montevileo and from southern England to Nigeria. Not until the outbreaks in New Orleans and Panama City in 1905 did that era of devastation come to an end. The work of Carlos Finlay, Walter Reed, William Crawford Gorgas, Henry R. Carter and their colleagues paved the way to a spectacular and speedy disappearance of the disease from seaports and cities. That was the urban form of yellow fever transmitted by the *Aëdes aegypti* mosquito, a mosquito which now has been all but eradicated in Central and South America. Then in 1932 another form of transmission of the virus was discovered in Brazil by Soper, Penna, Cardoso, Serafim, Frobisher and Pinheiro (19). This was jungle yellow fever, so named because of the typical broadleaf tropical rain-forest of the Amazon Basin in which it was found to exist. Both are forms of the same disease, and differ only in their mode of transmission.

Jungle, or sylvan yellow fever is transmitted by forest mosquitoes that frequent the tree-tops, breed in tree-holes, and are most active around mid-day during the rainy season. For a time it was known as "woodcutters' disease" since the mosquitoes come down when trees are felled, bite viciously and can be recognized by their metallic bluish lustre. They also come down to ground level in clearings, roadways, riverways, and in cacao plantations. Since much of the subsistence farming of Central America is based on a forest type of agriculture, the impact of such a disease upon the rural and farming population can readily be appreciated.

Col. Elton who commands the Chemical Corps Medical Laboratories at Army Chemical Center, Md., was previously stationed in the Panama Canal Zone where he carried out extensive studies on the control of jungle yellow fever. It was in recognition of this work that Colonel Elton was awarded the Louis Livingston Seaman prize for 1953 by the Association of Military Surgeons of the United States.

Colonel Elton is a native of Boston, has a BA degree from Harvard College and an MD degree from The Boston University School of Medicine.

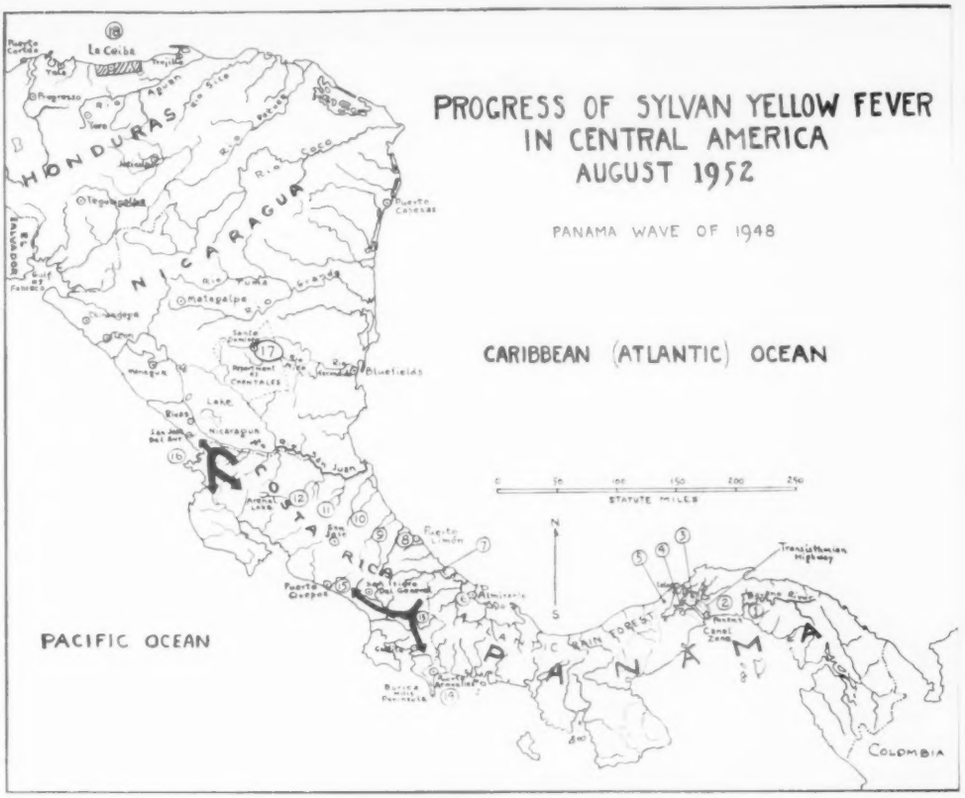
On 29 September 1954 word was received that the livers of two recently dead monkeys from La Masica, 10 miles west of La Ceiba, have been diagnosed as typical of yellow fever, one by Dr. Carl M. Johnson, Director, Gorgas Memorial Laboratory, Panama, Republic of Panama, and the other by Dr. Gast-Galvis in Bogota, Colombia.

At the present time (September 29, 1954) the area about to be invaded by the wave has just been devastated by hurricane "Gilda." The effect that will have on the spread of the wave will be of great interest.—Author.

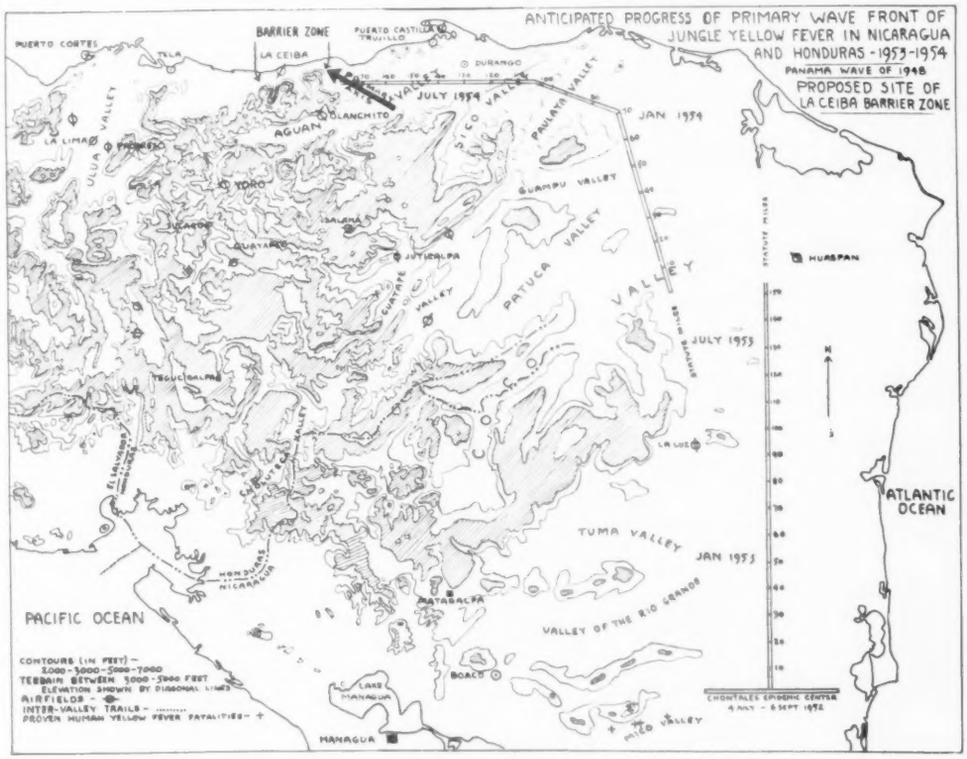
Although extensive vaccination programs have preceded the current wave in Middle America, the sickness and death rates have been high, and in Costa Rica alone, where outstanding control measures were carried out, 206 patients were hospitalized between July 1951 and March 1953. Among this group there were 56 fatalities before the wave had spent itself (18).

Wave action can be partially explained by the wind-drift of infected forest mosquitoes. The reservoir of the virus probably exists largely in the arboreal mammals, hence areas where the disease is constantly present are known as enzoötic areas. Waves seem to originate from these enzoötic areas at as yet unpredictable intervals, spreading like forest fires and accompanied by epizoötic episodes involving non-immune arboreal mammals, especially monkeys, as they progress through the contiguous rain-forest. Causey, Kumm and Laemmert (2) have shown that marked forest mosquitoes can be blown by the winds as far as 7 miles. If, after a wave motion is initiated, infected mosquitoes are blown into a region inhabited by susceptible animals, these non-immunes will become infected, circulate the virus, and serve as a source for the next 7-mile jump of newly infected mosquitoes. This 7-mile estimate is probably a conservative one. If, on the other hand, the mosquitoes drift back into the region already involved nothing will happen because the arboreal animals there have either died of the disease or have recovered and become immune, unless, for reasons as yet not understood, it is a stabilized enzoötic area.

In this process man may be only an accidental victim, but the Mayan records (3) contain irrefutable evidence of a scourge of "xekik" (bloody vomiting) that measurably decreased the population of Yucatan in 1484 long before the introduction into, and establishment in the New World of the Aëdes *aegypti* mosquito by the ships of the European settlers. The epidemic is so clearly described that it could only have been yellow fever in its purely sylvan form. As recently as the early months of 1951 what was probably the greatest outbreak of jungle yellow fever in modern times occurred in the States of Goiaz and Minas Gerais in Brazil. Thousands of settlers had migrated to this region from northeastern Brazil without having been vaccinated. The toll was 400 deaths out of 3000 recognized clinical cases.



(Fig. 1—See Page 28)



(Fig. 2—See Page 29)

Pattern of the Current Wave in Middle America

The importance of the coastal strip in the vicinity of La Ceiba in northern Honduras has not been stressed without reason (4, 5, 6, 21). Whatever may have been the pattern of prior waves of yellow fever in Brazil since 1932, this contemporary wave in Middle America has presented a number of distinctive features of its own.

Natural Barriers. Reasonably conclusive evidence now exists that the 2000-foot contour has up to the present time acted as a natural barrier against the arboreal mammal-forest mosquito propagation of sylvan yellow fever in Central America and that this barrier can be crossed only by human carriers of the virus, such as migrant farmers fleeing from epidemic areas and crossing over mountain trails into uninvolved valleys or watersheds where they may infect forest mosquitoes that would not naturally have been in the path of the main wave, and produce secondary waves. This is probably what happened in southern Costa Rica, causing the outbreaks on the Pacific Side in the Province of Puntarenas where the continental divide is 7000 feet high, and this is what could cause a by-pass of the La Ceiba region over the roads and trails leading into the southern part of the Ulua Valley in western Honduras especially during the activity of the recent epidemic center in the vicinity of Juticalpa (January 1954), unless such migration has been adequately controlled by vaccination stations and check points (6).

Romero and Trejos (18) report that all of the 206 patients admitted to San Juan de Dios Hospital in San Jose during the outbreak in Costa Rica acquired their infections in localities not over 500 meters (1640 feet) above sea level. Trapido (20) has also observed that a commonly recognized vector of jungle yellow fever, *Hemagogus spegazzinii falco Kumm*, is most abundant at about 500 meters elevation in Panama. There is as yet no evidence to indicate that the 2000-foot contour will not continue to act as a natural terrain barrier.

Other terrain barriers are provided by deforestation, open country, and agricultural development, as well as by climatic factors such as lack of optimal variations in seasonal rainfall. These factors undoubtedly operated in preventing the secondary wave in southern Costa Rica (Province of Puntarenas) from re-entering western Panama on its Pacific watershed, where there has been no evidence of any activity east of Puerto Armuelles to the Panama Canal at any time in recent years. Although many monkeys died in the southern part of the Isthmus of Rivas just west of Lake Nicaragua, the main axis of the wave continued to follow the Atlantic watershed of Nicaragua. The western portion that split off at this point was blocked in the vicinity of Rivas from its northward trend by lack of suitable forest and climate, and turned west across the break in the continental divide (below the 2000-foot contour), swinging southward into the Nicoya Peninsula and southeast down the Pacific side of Costa Rico as a daughter wave.

Velocity. The over-all velocity of the wave between epidemic centers has consistently averaged about 13 miles per month. On this basis quite accurate predictions have made possible the timing of vaccination programs (7, 8, 9).

Epidemic outbreaks. Although human cases have occurred sporadically throughout rainy seasons, certain months following a brief period of optimal rainfall, as suggested by Fairchild and Trapdoi (10), such as July, August and September have frequently been associated with epidemic outbreaks, especially on the Atlantic side of the countries so far involved. These epidemic outbreaks have run a self-limited course of a little better than 2 months duration in any given locality before the wave moves on, which may perhaps be related to the life span of a brood of the vector mosquitoes, estimated for *Hemagogus spegazzinii falco Kumm* as ranging up to 65 days.

The epizoötic phase. That the arboreal primates (howler, spider and marmoset monkeys) are highly susceptible to yellow fever virus is now well established through the observations of Balfour (1), Gaitan (11), Laemmert and de Castro Ferreira (14), Laemmert and Kumm (15), Kumm (13), and Vargas and Elton (21). Experience in Costa Rica has fully confirmed the earliest reports of Balfour and Gaitain that the epizoötic phase may streak ahead of the epidemic phase and that death and sickness among the monkeys of the forest often are precursors to subsequent epidemics among the human population. At other times the two phases seem to occur simultaneously. A possible explanation of this phenomenon is that a long stretch of forest following approximately the 500 meter contour may act as the focal line or source of the epizoötic phase, whence infected mosquitoes drift downward after a lapse of time over a wide front all at once into localities at lower elevations. In this manner the 100-mile epidemic outburst in northeastern Costa Rica that lashed out from July-October, 1951, could be understood. Even while the epidemic centers originating from this Costa Rican front were still active, monkeys had begun to die several miles to the north along the San Juan River in Nicaragua. So now, (May 1954), the capricious epizoötic phase seems to have reached Durango and Yaruca on the north coast of Honduras, and may be expected to extend westward along the north slopes of the Cangrejal range of mountains west of La Ceiba, since similar proximity of mountains to seacoast did not check its progress in Panama in 1950-51.

Vaccination of the human population. Although this preventive measure effectively protects the people in the rural areas involved in the sweep of the wave, it has no effect whatsoever upon the movement of the wave itself. Furthermore adequate coverage of the population in the critical areas is always difficult because of the dispersion and inaccessibility of the inhabited localities. Many factors contribute to making 100 percent effectiveness of vaccination campaigns impossible, hence human cases will constantly be encountered.

The wave has not doubled back on itself. Once a region is cleared by the wave no residual activity has yet been found to persist, and conditions appear to be restored to

the status prevailing before the wave arrived, especially insofar as the human population is concerned, although the arboreal primates have at times been reported to continue to die sporadically for several months after the epizoötic peak has passed. However, the cause of this continued mortality in monkeys has not yet been investigated. No definite foci of residual enzoötic activity have been identified in its wake. Much of the arboreal primate population, however, has been wiped out, and what remains is largely immune.

No urban component has been noted. So far cities and the smaller urban centers have not been involved. This is because of the extensive use of insecticides during the past decade for the control of malaria and for the control of the *Aëdes aegypti* mosquito itself. Hence the epidemiologic pattern has been purely sylvan in character.

The impending impact on northern Guatemala and Yucatan. The departments of Izabal, Alta Verapaz, Baja Verapaz and Peten in northern Guatemala, Belice (British Honduras) and the "Tierra Caliente" of Mexico (including Yucatan) are historic regions of the ancient Mayan and Aztec Empires that have been swept over periodically by sylvan yellow fever even in Pre-Columbian times, and now if La Ceiba is passed, we shall witness a repetition of this historic episode on the traditional hunting ground of this savage virus in its primitve form.

General Comments

There is much that is still unknown about jungle yellow fever, such as the factor that initiates wave action, how the virus is maintained during dry seasons, why enzoötic areas remain active or dormant, and what animals or mosquitoes constitute the primary reservoir of the virus. Other viruses exist in forested regions or regions near forests which may cause diseases simulating yellow fever, but which are more typical of infectious hepatitis, such as *fiebre Chontaleña* (Chontales fever) in Nicaragua, and Santa Marta hepatitis in Colombia. These, however, can be differentiated histologically by their liver lesions in cases terminating fatally, and by mouse-protection tests before and after a specific illness in those who recover.

The efficacy of vaccination is still not satisfactorily determined, whether by the use of the 17D embryonated vaccine or the Dakar mouse brain vaccine. Experimentally both vaccines have been shown to afford a remarkably high degree of protection. In Costa Rica the Dakar vaccine was widely used, yet the mortality from the naturally acquired disease was not fully controlled. In the 157 patients studied by Romero and Trejos during 1951, 65 had not been vaccinated, among whom 24 died, with a mortality of 37%; whereas 92 had been vaccinated, among whom 19 died, with a mortality of 21%. Whether or not this failure was due largely to a deterioration of the vaccine is still not fully understood, since comparison with the efficacy of the 17D vaccine under comparable conditions was not possible at the time. It is hoped that additional information may have been acquired in Nicaragua or will be obtained in the near future from Honduras and Mexico.

Although the yellow fever virus has long been regarded as a single strain and attacks of the naturally acquired infection have generally conferred lasting immunity upon recovery, it is curious to note that such an authority as Rudolf Matas (16, 17) considers that he himself acquired the disease four times, contracted in the course of as many typical and historic epidemics and diagnosed by competent experts in 1867, 1878, 1879 and 1882, after which, in 1943, he was found to have attained positivity in the mouse protection test.

If, in the years to come, further settlement of the tropics

(Continued on page 28)

Outstanding ROTC Cadet

Jack Miller, Reynoldsburg, Ohio, a senior at Ohio State University, majoring in marketing, was selected as the outstanding R.O.T.C. cadet among the 350 cadets from 62 colleges and universities who attended the six-week R.O.T.C. camp at the Chemical Corps Training Center at Fort McClellan, Alabama, this summer. Cadet Miller

Cadet Jack Miller of Ohio State University (right) receiving award as the outstanding cadet at the Fort McClellan ROTC Camp from Colonel Edwin Van Keuren, Commandant of the Chemical Corps School.

gained attention for his military bearing and command voice in leading his company (Company D) in parade. His position assignments included detail twice as company commander, four times as first sergeant, and twice as color guard. Cadet Miller hopes to obtain a commission in the Regular Army upon completion of his college work. He is a member of the Scabbard and Blade, honorary R.O.T.C. society, and Alpha Tau Omega social fraternity. He is enrolled as a sergeant in the 614th Anti-Aircraft Artillery Battalion (Reserve).

YELLOW FEVER

(Continued from page 27)

by North Europeans similar to that made possible by Gorgas on the Isthmus of Panama is contemplated, it is not by any means a task to be undertaken lightly. Too often *we* forget, although it is quite apparent that diseases originating in the tropics, such as yellow fever, have not forgotten us.

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INTERPRETATION OF MAPS

Figure 1

This map depicts the progress of the contemporary Central American yellow fever wave from its source in eastern Panama to the Mico Valley in Nicaragua during the period November, 1948 to July, 1952. The numerals indicate events of interest in the order of their occurrence.

Area 1. The region east of the Bayano River has been a focus of enzoötic yellow fever for an indefinite length of time, but with certainty since 1929. This region may well have been the most important center for dissemination of the disease over the trade routes of the Atlantic from the early days of colonization in the New World.

Area 2. Here during November and December 1948 in the Pacora District in the vicinity of the Tocumen Airport, five farmers acquired an acute fever of short duration and died in Santo Tomás Hospital in Panama City. Autopsies were performed on all of them, and the cause of death was considered to be epidemic hepatitis until Dr. Juan M. Herrera, who had never before encountered yellow fever, began to review the pathologic material he had obtained. Confronted with a most delicate international situation because of the action of Egypt early in December, 1948, declaring both Panama and the Canal Zone to be within the endemic area of yellow fever and an immediate official protest from the Republic of Panama that there was no yellow fever in Panama, he sought consultation from several sources without success, until on 14 January 1949, he requested a consultation by, and obtained confirmation of his suspicions from a representative of the Board of Health Laboratory of the Health Bureau of the Canal Zone Government, who assumed full responsibility for the pathologic diagnosis of yellow fever in two of his autopsied cases. Shortly after this incident the Congress of the United States authorized and appropriated $500,000 for the control of yellow fever in Panama and the Canal Zone.

Area 3. In spite of an intensive vaccination program that had already been undertaken, three human fatalities occurred in the Buena Vista area between the transisthmian highway and the east boundary of the Canal Zone during the months of August and September, 1949. These were diagnosed by autopsy and confirmed locally as due to yellow fever by Dr. Herrera and the Board of Health Laboratory, and measures were taken to insure prompt notification of all interested agencies.

Area 4. This is Barro Colorado Island, a memorial to Dr. Thomas Barbour and other great naturalists, and a wildlife preserve in Gatun Lake, inhabited by some 37 clans of howler monkeys as well as many other animals. Studies conducted by Collias and Southwick in 1951 (Proc. Am. Philos. Soc. 96: 143-156, 1952) disclosed that the clans of howler monkeys on Barro Colorado Island were markedly depopulated by an epizoötic shortly after the dry season (Jan.-April) of 1949.

Area 5. In January, 1950, a proven human fatality originated from the Chagres District west of the Canal Zone. At this time it appeared certain that a wave was in progress, and on 20 March 1950, Costa Rica was alerted by her Consul-General in Panama to expect involvement of the Atlantic side of that country in from 14 to 18 months.

Area 6. In April, 1951, a workman engaged in a highway survey through virgin forest on the Atlantic side in western Panama died of yellow fever in the Almirante Hospital of the Chiriqui Land Company. Within a week an intensive vaccination campaign was undertaken in Costa Rica. For the first time sufficient data were available to make a fairly accurate estimate of the over-all velocity of the wave.

Area 7. In June, 1951, the virus of yellow fever was isolated by Dr. Enid de Rodaniche from a blood specimen submitted to Gorgas Memorial Laboratory from the Almirante Hospital. The patient, who recovered, acquired his infection at Nievecita in Costa Rica, close to the Panama boundary.

Areas 8, 9, 10, 11 and 12. Beginning with an initial fatality on 24 July, 1951, five epidemic centers flared up in rapid succession from east to west along a 100-mile front, with activity lasting until October, in the provinces of Limón, Heredia and Alajuala. Scores of patients were hospitalized in San José, and 38 fatalities occurred.

Areas 13, 14 and 15. In October, 1951, an epizoötic and epidemic outbreak developed on the Pacific side in the southern part of the province of Puntarenas and began expanding to the northwest and the southeast. The southeast spur died out in the Burica Hills Peninsula and failed to re-enter the Pacific watershed of western Panama. The northwest spur eventually met with a daughter wave coming down from northwestern Costa Rica and disappeared about March, 1953. This crossing of the con-

tinental divide from the Atlantic to the Pacific side was unique and can be accounted for probably only by the seeding of the mosquitoes of the Pacific forest by a migrant farmer fleeing across the Talamanca Trail from the epidemic areas on the Atlantic side in June or July, 1951, after he had become infected in southern Limón.

Area 16. Although there is some confusion here, fairly conclusive evidence was acquired by following the pathway of the epizoötic episodes and the study of monkey livers, that a daughter wave resulting from the split at Lake Nicaragua swung westward across the break in the continental divide in northwestern Costa Rica, after failing to advance above the southern part of the Isthmus of Rivas in Nicaragua, and expanded southward into the Nicoya Peninsula and southeastward along the Pacific slope of the continental divide to close with the secondary wave moving up from Puntarenas, and then died out. A previous concept that a crossing occurred over the saddle formed by Arenal Lake has been proven erroneous.

Area 17. Here in the Mico Valley in Nicaragua close to the 1,000-foot contour, an epidemic outbreak occurred, as predicted, in July, 1952, lasting until September (about 2 months).

Area 18. No opportunity having been afforded to make a personal reconnaissance, estimates had to be made from a study of maps, all of which differed in topographical details, concerning the feasibility of establishing a tentative barrier zone at La Ceiba in northern Honduras where a natural terrain funnel appeared to exist. This project has been mentioned in three publications in the open literature of 1952 and 1953 and will be discussed in the interpretation of Figure 2.

Figure 2

At the conclusion of the Mico Valley epidemic center in Nicaragua, since it was believed that the topography of that country would not be conducive to the maintenance of close contact with the main axis of the wave and its daughter waves or with the contingency of secondary waves, as was possible in Costa Rica, a long range time table was drawn up extending as far as La Ceiba, in the hope that some agency might see fit to implement measures recommended to reinforce this natural bottleneck as a barrier zone before the main axis reached it.

A succession of epizoötic and epidemic episodes occurred in Nicaragua involving the Tuma Valley, the region around La Luz, the Coco Valley, and the Patuca and Guampu Valleys, as the main wave front moved northward, and the vicinity of Juticalpa by an offshoot up in the Guayape Valley, pretty much on schedule.

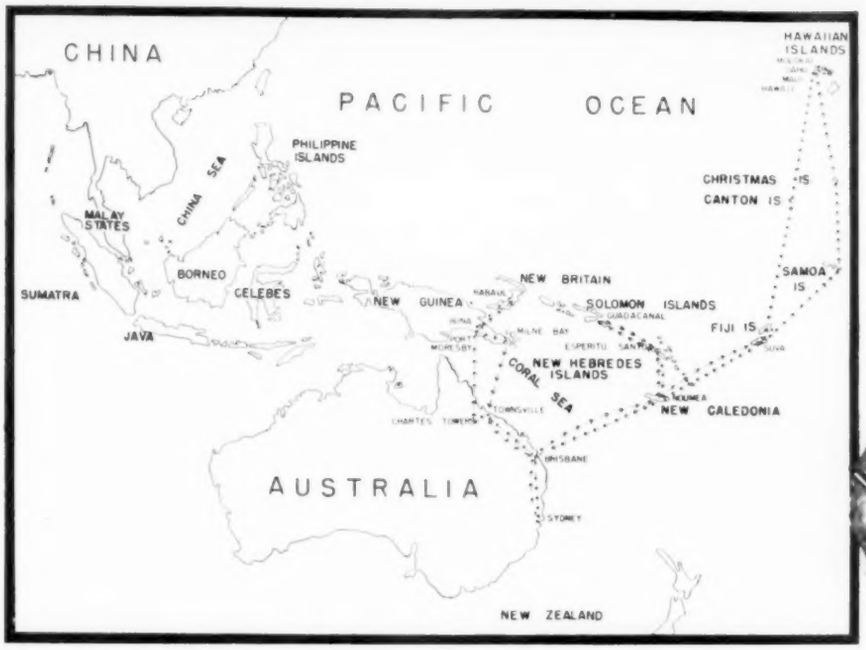
It had been suggested by some observers that the range of the mosquito *Hemagogus spegazzinii falco Kumm*, a known vector, probably ended somewhere in the vicinity of the boundary between Honduras and northern Nicaragua, and that if the wave did not stop there, some other forest mosquito with different bionomic characteristics might become involved and the pattern of the wave would change. Probably for this and sundry other reasons it was considered futile to attempt the La Ceiba project.

At the present time (May, 1954) an epizoötic is causing monkeys to die in northeastern Honduras in the vicinity of Durango, and curiously enough also in the vicinity of Yaruca, 20 kilometers southeast of La Ceiba in the valley of the Cangrejal River which parallels the highway from Olanchito to La Ceiba and empties into the Gulf of Honduras. Since the La Ceiba project contemplated a state of readiness of the barrier zone by January, 1954, because of the recognized tendency of the epizoötic phase to streak ahead of the epidemic phase at times, it appears likely that it is now too late to attempt to do anything more about it, for the epizoötic spearhead has probably already passed along the northern slope of the Cangrejal range a few kilometers southwest of La Ceiba itself and is well on its way toward the Ulua Valley, northern Guatemala, Belice and Yucatan. It would be interesting indeed to examine livers of the Yaruca monkeys under the microscope in order to ascertain with certainty, if yellow fever was the cause of their deaths, for although involvement of the Durango area would be consistent with the anticipated progress of the wave, the monkeys of Yaruca should be carefully examined before their significance can be evaluated, especially since a recent similar episode in the vicinity of Managua, Nicaragua, proved to be a false alarm.

Since this manuscript was prepared, reliable information has been received that monkeys are dying in the Department of Atlantida on the north coast of Honduras at San Francisco, 25 kilometers west of La Ceiba, and at Esparta, 10 kilometers further to the west (June 1954). Evidently the epizootic spearhead has already passed directly through the proposed barrier zone, and the wave is definitely on its way to Guatemala and Mexico.—Author.

MAJ. SCHWIMER TO HAWAII

Major Joseph Schwimer, Assistant for Public Affairs at Camp Detrick, Maryland, has been assigned as managing editor of ARPAC News, Army newspaper in Hawaii. He is now attending a two-month officers' course at the Troop Information and Education School, Fort Slocum, New York. Major Schwimer was one of the original members of the AFCA and served as secretary-treasurer and advertising manager for several years.



FORTY-FIVE DAYS UNDER THE SOUTHERN CROSS

By Robert D. McLeod, Jr.
Colonel, USA (Ret.)

(This is the second half of Colonel McLeod's narrative of his trip to the South Pacific in 1943 which preceded his selection of San Jose island off the cost of Panama as a tropical proving ground of the Chemical Corps in World War II. Colonel McLeod, as the story of his trip is continued here from the September-October issue of the Journal, is aboard an airplane of the 13th Attack Squadron, returning to its base in New Guinea from a successful mission to attack and sink an enemy ship. This article was written by Colonel McLeod while he was on duty with the Historical Office of the Chemical Corps, Army Chemical Center, Md., shortly before his retirement last July. —Ed.)

As we drew away from New Britain the leader took the bombers up to about 12,000 feet. After a while he asked me if I wanted to take over the controls. I declined as I was perfectly happy to have a competent pilot doing the flying at a time when we might still run into some hostile aircraft. It was a beautiful clear day and the visibility was excellent. Suddenly almost ahead of us we spotted a large Japanese submarine. We had used up all of our bombs against the Japanese steamer so our only remaining weapons were our machine guns. The pilot made a steep dive in an effort to get a shot at the submarine. However, the enemy had spotted us about the same time that we saw him and was able to submerge before we got into range. We reported his position to our home base and a special task force was sent out to get him. I never heard the result of their search. Upon our arrival at Dobodura we returned to the briefing room where we gave an account of our experiences.

That afternoon was spent visiting the base at Dobodura and looking at samples of jungle. We saw some of the natives who were very primitive. The jungle was particularly noteworthy for tall trees and innumerable vines of great length and considerable size. Few wild animals inhabit the jungles in New Guinea. Wild boars are the most dangerous animals and there are some pythons and coral snakes. While there is little danger from the animals, New Guinea has many diseases, such as malaria, dengue, dysentery, and bush typhus. The streams were highly polluted and the natives were carriers of malaria. Native houses were built of long poles and covered with sago palm leaves. The center of the leaf furnished the thongs by which the thatch was tied to the pole. The structures were very satisfactory in that they were cool and economical to build with native labor. However, most of the houses were alive with insects.

I returned to Port Moresby the following morning. I attended a weekly conference of the Chemical Warfare officers held in Major Cummin's office. That afternoon I visited Brigadier General R. H. Van Volkenberg of the 40th Coast Artillery Antiaircraft Brigade. There I was shown the Japanese antiaircraft dispositions around Rabaul and the paths of Japanese attacks on Port Moresby. I also visited the chemical officer of the fighter command, Major Tooey, on the way back to camp. Major Cummins

stated that he was making arrangements to gather meteorological data at Port Moresby, Milne Bay, Wau, Dobodura, Buna and Buna Missions. I had a conference with Lt. Col. R. V. Dickson, Ordnance Officer of the Advanced Echelon Fifth Air Force and Major Cummins. It was decided that there should be a closer tie between Ordnance units and the CWS air operations companies. No definite plan was agreed upon.

After leaving Port Moresby I flew to Milne Bay arriving at the airport in Giligili. From there we took an amphibian truck to Ahioma where an advanced Army base was located. This was the first time I had ever gone to sea in a truck but the amphibian made a very good motor boat and I enjoyed the trip. Milne Bay is a tremendous bay of great beauty. However, the base was located on low swampy ground which made a very poor camp site. There I met Captain R. C. Morris, the base chemical officer, who showed me around. I returned to Giligili for the night. That evening at the officers' mess I noticed that more than my share of the colored waiters were hovering around me. I questioned one of them and found that the men were all from the 28th Chemical Decontamination Company. The waiter said that I was the first Chemical Corps colonel they had seen since coming overseas. They really rolled out the welcome mat. The next morning I caught a plane which flew directly to Townsville from Milne Bay. After an overnight stay in Townsville I returned to Brisbane and made arrangements to leave for New Caledonia.

Use of power decontaminating truck for spraying insecticide on mosquito-breeding places in Waikiki to combat dengue fever. At left in the picture is Col. George Unmacht, who was Chief Chemical Officer of the Central Pacific Theater in World War II.

Trip to New Caledonia

Shortly after midnight on the 25th of July, I left Brisbane on a four-engined plane operated by the Air Transport Command. When we were about three hours out one of the motors died and we had to turn around and come back. Not much sleep was enjoyed on the way back as we were all too interested in seeing that the other motors kept running. However, we reached the airfield without further mishap and were able to proceed the following day, reaching Plaines des Gaiacs in New Caledonia about 6:00 a.m. I drove down to Noumea and went to Fort Barnes, the headquarters of the Island Command, to see Colonel (now Brigadier General) Leonard Greeley, the chemical officer of the command. I was told that Colonel Greeley was now deputy chief of staff for Major General Millard F. Harmon and was actively engaged in directing the operations against the island of New Georgia from the advanced headquarters at Guadalcanal. I returned to Plaines des Gaiacs in order to catch a plane for Guadalcanal by way of Espiritu Santo.

While there I found a French laundry which would wash my clothes while I made the trip to Guadalcanal. On the way to Espiritu Santo I traveled with Brig. Gen. Ray Owens who was going to the headquarters of the Thirteenth Air Force. General Owens invited me to stay with him at his quarters.

A number of enlisted replacements were on the plane. One of them kept laying his rifle so that it would point at either General Owens or at me. Since neither of us enjoyed looking down the barrel of a gun we firmly but gently placed the rifle in a position where it could do no damage and made the soldier keep it there.

The headquarters of the Thirteenth Air Force was in a coconut grove on a sloping hill. It was well drained and was high enough to catch a good breeze. It was an excellent camp in every respect. The acting chemical officer was a 1st lieutenant named Parker who was enthusiastic about his work. Major Embree Hockenbeamer was due to arrive in the near future and would be assigned as chemical officer for the Thirteenth Air Force. We visited Major Tucker, the chemical officer of the Island Service command. During my visit two officers of the New Zealand Army Chemical Service dropped in. They were Capt. J. Melville and Flight Lt. J. R. McFarlane. They told me that Major Gorrill of the British Army Medical Service was returning to Australia from England and that he planned to set up a laboratory at Melbourne and an experimental station at Gympe northwest of McKay.

New Guinea native house built of long poles covered with sago palm leaves.

We also discussed new developments in British chemical munitions.

I dropped over to the Navy base to see the Naval chemical activities. Lt. Goldberg was the Navy Chemical Warfare officer. He was a graduate of the Chemical Warfare School and was very interested in the subject. He had six smoke generators that he planned to test soon. He complained that his allowances of chemical munitions were based on ship board use and were inadequate for a shore installation.

From Espiritu Santo I flew to Guadalcanal where I met Col. Robert N. Gay, the chemical officer of the XIV Corps. We drove over to the headquarters where I talked with Major General Millard Harmon and Colonel Greeley. The attack on the Japanese in New Georgia was just getting under way and everybody was quite busy. I asked Colonel Greeley if I could get over to New Georgia to see some of the fighting. He said that this was impossible as they were short of shipping and that the men at the front would rather have a couple of hundred pounds of

food or ammunition than the same weight in a visiting officer. I could see he had a point.

The next day Lt. Col. Nelson McKaig, chemical officer of the 25th Division, drove me to the mouth of the Tenaru River where the Marines had fought a battle with the Japanese. From there we went to Henderson Field, Fighter Strip One, Fighter Strip Two, Lunga Beach, Kukum Beach, the Matanikau River and Kokumbona.

The following day I drove with Colonel Gay to the battlefield on Mount Austen which rises to an altitude of 1,514 feet and dominates Henderson Field. There I saw Japanese dugouts, equipment and many bones. We worked our way through tropical jungles leading to well camouflaged Japanese dugouts. It was evident that the Japanese preferred jungles and valleys while the Americans preferred high open ground. The deep forest pockets which were favorite haunts for the Japanese would have made ideal targets for toxic gas. Colonel Gay was very much impressed with the self-propelled Japanese smoke and signal candles. These little candles could be stuck in the ground with a steel spike and fired a smoke canister into the air. The smoke would clear the trees and could be used as a signal to either air or ground observers. The candle had innumerable possibilities. Colonel Gay stated that our flame throwers were in great demand by the infantry but that certain defects had developed. He was also having great difficulty in obtaining adequate supplies of nitrogen and hydrogen to supply the flame throwers. We had lunch with the 886th Chemical Company, Air Operations, which had just moved to Kearny Field. This outfit had been assigned a spot of jungle on the edge of the field and told to build themselves a camp. They were doing a very good job and had rigged up a most ingenious washing machine to do the company laundry. It was made of Signal Corps wire reels of different sizes driven by an engine from a jeep. Hot water was supplied from GI cans heated over a big pit.

While at Guadalcanal I was shown a Japanese frangible grenade filled with hydrocyanic acid. The container was a glass sphere about the size of a small fish bowl. The HCN was a colorless liquid. There was a small amount of metallic copper at the bottom for a stabilizer. Seeing this grenade brought to my mind the fact that at the Edgewood Arsenal some containers of HCN had exploded due to polymerization of the chemical. It seemed to me that exposure of the grenade to sunlight might well bring on such a reaction and I therefore recommended that the grenade be destroyed.

From Guadalcanal to Noumea

The next day I left Guadalcanal for Noumea, stopped for lunch at Espiritu Santo and picked up my laundry at Plaines des Gaiacs. The airplane was full of wounded men being flown back from the fighting on New Georgia. We were told to watch for signs of a similar plane which had disappeared the day before.

That night I stayed in the Pacific Hotel in Noumea, which was a rambling structure of two or three stories covering a large area. A huge bar room was being used as the local officers' club and it was being well patronized by all branches of the service. I could easily visualize earlier days when traders from the South Seas gathered in the hotel and drank their gin or rum over that same bar. The town itself was a squalid, drab place and very poorly lighted at night. It looked like a good place to get your throat cut.

The next day was spent with Lt. Col. Joel L. Burkitt, the acting chemical officer of the U. S. Forces in the South Pacific Area. We drove out to see Lt. Col. William H. Shimonek who had just recently arrived with the 82nd Chemical Mortar Battalion which was soon to participate in the fighting. He was interested in my experiences and I gave him all the advice I could in the light of my recent observations.

My next visit was the SOPAC Depot where the commanding officer was Col. Joseph H. Burgheim, an old acquaintance who had been Quartermaster of March Field, California. The chemical officer, Major J. W. Davis, took me to the camp of the 99th Chemical Composite Company where I met the company commander, Lt. Elwyn R. Richter. Three new warehouses and a toxic gas yard were being built for the storage of chemical supplies. We drove to the old toxic gas yard to inspect some leaky mustard gas bombs. There I saw a novel method of storing gas bombs which consisted of removing the bombs from their boxes and storing them in open racks. This permitted daily visual inspection of each bomb and simplified the removal of leakers. I later adopted this idea for the storage of mustard gas bombs for the San Jose Project.

My time was running short so I took an airplane from Tontouta for Plaines des Gaiacs in order to catch the regular ATC run back to Hawaii. When I arrived there I found that I could not get a plane out until the next morning so I had to find a billet for the night. A number of four-bed huts which they dignified with such names as the Astor, the Ritz, and the Biltmore were the visiting officers' quarters. I was assigned a bed in the Astor. Shortly after I was settled a plane came in from the north. The passengers of the plane got out and were assigned billets for the night. Soon an officer appeared at the door of the Astor and I recognized him as Major Hockenbeamer who was on his way to Espiritu Santo as

chemical officer of the Thirteenth Air Force. I was very glad to see him as there were a number of things I wanted to tell him. We had hardly settled down when a British officer entered as a third guest in the Astor and to my great surprise I found that he was Major Gorrill whom I had hoped to find in Australia but who had returned to England. Major Gorrill was on his way back to Australia to continue his tests. I was delighted to see him and get a chance to talk about his plans. I have often wondered what the mathematical odds were against my meeting two people I was very anxious to contact, in a four room shack in the middle of the Pacific Ocean, on the only night that I stayed at that spot. We had a most enjoyable and profitable visit.

Return to Hawaii via Samoa

I was given a choice of routes back to Hawaii and chose to return by way of Samoa and Christmas Island rather than by way of Canton Island which was the route I took down. After leaving New Caledonia we stopped for lunch at the Fiji Islands then proceeded on to Samoa. The landing strip on the islands of Tutuila consisted of a long artificial strip of land stretching out into the sea from the shore. Steep hills rose from the water's edge. It was strictly a one direction flying field. However, we landed without any trouble and I had my first view of Pago Pago harbor which I had wanted to see for many years. The next day I visited the Navy Yard and then drove along the southern shore of Tutuila as far as Leone Bay. The Samoan Islands are exceedingly beautiful and the natives picturesque and friendly.

We left Samoa at 2 p.m. for Christmas Island and arrived there about midnight. A storm had come up and it was with great difficulty that we located the air field. However, since it was the only place we could land for about a thousand miles, we had to make it. After several passes the pilot finally put the wheels down on the runway and we all heaved a sigh of relief. Christmas Island is a rather small island with large coconut plantations. It was interesting to visit but I wouldn't care to live there in spite of the song written about it.

We left Christmas Island the following morning for Hickam Field, Hawaii. As mentioned before, on the way south from Hickam Field we had temporary seats installed in our converted B-24. On the way home they had taken out the seats so that they could carry more mail. As a result we had to sit on the mail bags. I think the soldiers must have sent Japanese daggers, Samurai swords and shell fragments home by mail as the objects in the bag were exceedingly hard and sharp. Needless to say, it was not a comfortable trip.

We arrived at Hickam Field at 4 p.m. and I was billeted in a beach cottage on Waikiki Beach. The Army had taken over a group of beach cottages with a central dining room as a rest hotel for men returning from the combat zone. I anticipated a very pleasant stay in Hawaii. The next day I visited Col. George F. Unmacht, Chemical Officer, Pacific Ocean Area. He introduced me to the members of the staff and of his office and gave me an outline of his activities. Colonel Unmacht had done an outstanding job of chemical warfare training in the Hawaiian Department.

The following morning as I was eating breakfast a Navy plane buzzed the hotel and nearly took the roof off. Later in the day I learned that the same plane that had buzzed our hotel had come too close to the ground near the entrance to Pearl Harbor and had crashed. Just as I was finishing my breakfast Major E. K. L. Doty of Col. Unmacht's office drove up and told me to move out of the hotel at once as they were going to put Waikiki Beach in quarantine for dengue fever. The CWS had been called on to furnish a power driven decontaminating apparatus to spray the haunts of dengue-infected mosquitoes with oil. (See picture). This is another example of the many uses of this versatile piece of equipment. I loaded my things in his car and we drove to a BOQ at Fort Shafter. While this was comfortable, it was not nearly as pleasant as my beach cottage. I began to think I hadn't been so smart in leaving the beach before the quarantine went into effect. I can't imagine a more pleasant place to be in quarantine than a beach cottage on Waikiki. Col. Unmacht drove me out to Hickam Field where I met Lt. Col. H. S. Leach, the chemical officer of the Seventh Air Force. I also met Brig. Gen. William Flood who had been Air Force Officer at Edgewood Arsenal for many years and whom many of us in the CWS well remember. General Flood asked us to lunch with Maj. Gen. Willis H. Hale, the commanding general of the Seventh Air Force, and Brig. Gen. Robert W. Douglass. The following day, Lt. Col. Leach took me around to the outlying air fields. I had served in Hawaii before the war and was shocked to see how the war was affecting the islands. Barbed wire was strung all along Waikiki Beach, a very early curfew was in force and the restaurants were so crowded that it was almost impossible to get a meal away from any Army mess. Innumerable honkey tonks had sprung up and the friendly, leisurely atmosphere of the islands had disappeared.

My next visit was to Schofield Barracks. It had greatly changed since I was stationed there in 1931. The Chemical Warfare Depot had been expanded and included an impregnating plant which was well managed and had a fine laboratory that made several important contributions to the war effort. On August 12 I flew to Maui. We landed at Molokai on the way. As we took off the landing gear collapsed and the airplane slid along the ground bending the propeller. We had to wait for another plane to be sent over from Hickam Field before we could continue our journey. Maui is a beautiful island, one end of which is formed by the large volcano Haleakala which rises from the sea to an altitude of 10,032 feet. I met Gen. Meyers, the island commander, and Capt. Jesse F. Wright, the chemical officer. I visited the chemical warehouses which were in splendid condition.

Returns "Commercial" from Hawaii

Upon my return to Oahu, Col. Unmacht asked me if I would care to return by commercial air. As I was still sore from sitting on those hard objects in the mail bags I jumped at the chance. Col. Unmacht contacted the transportation officer and arranged for me to return by Pan American airways. I reported to the Pan American dock on the shore of Pearl Harbor about four o'clock in the afternoon. I was surprised to find an attractive waiting room with uniformed attendants who served pineapple juice and cookies to the passengers while they were being processed. About 4:00 p.m. we went aboard a huge seaplane with a large central compartment. We were so heavily loaded that we taxied all over Pearl Harbor trying to take off. As we maneuvered around we had a good view of the sunken battleships. Finally we were in the air and headed back to the mainland.

I was seated at a table with the commander of the plane and two Negro clergymen, one an Army chaplain, and the other a bishop. The bishop was returning from a visit to colored troops in the South Pacific, which he told me he had made at the suggestion of Mrs. Roosevelt.

Once we had settled down on our course a waiter brought a tray of snacks which would have been tasty as an evening meal. About an hour later to my great surprise he appeared again, spread a table cloth on the table with appropriate silverware and proceeded to serve a

(Continued on page 40)

GOV. VAL PETERSON'S ADDRESS

Speech by the Federal Civil Defense Administrator at the symposium on Disaster Planning May 21, 1954 at the 9th Annual Meeting of A.F.C.A., in Washington, D.C.

I HAD HOPED that General Nelson† would be able to report to us that the Air Defense Command is now in a position to guarantee that no single Russian bomber will ever be able to deposit a bomb on the United States. Having heard that good news, I felt I would rush over to the White House and tell the President there were more pleasant things to do in this world than head Civil Defense.

As a matter of fact, I read something in the New York Times this morning that came pretty close to such a statement. A public official in one of our neighboring states was quoted as saying that our defenses had now reached a point where nine out of every ten Russian airplanes coming toward the United States would be destroyed. This is contrary to a statement made by General Vandenberg when he was Chief of Staff of the Air Force that seven out of every ten planes coming toward the United States would probably get through. I am afraid these figures are only reasonably well-informed guesses, and that the fact remains, should the enemy see fit to launch an attack upon the United States, too many will get through.

The attacker will know the percentage of loss to expect. It must be assumed that a reasonable opponent would not attack until he was able to take that loss and still place over American cities the number of airplanes and bombs that he thinks necessary to accomplish his mission. That, of course, would be to knock out as many American cities and as much American industry as he could, killing whatever millions of Americans as would happen to be caught in the cities at the time the bombs exploded.

It is the job of the military to prevent the attack. I, for one, have tremendous confidence in all branches of the American military, the work it is doing, the enthusiasm and knowledge with which it is approaching its task, and its long record of fine service to the American people. The job of civil defense is to minimize the attack after it takes place, and that, of course, is a tremendous job.

I believe that, should the Russians see fit to strike at the United States, they would try to hit from 40 to 100 American metropolitan areas. The exact number they hit will depend on their degree of readiness in aircraft bombs, and submarines carrying missiles with atomic warheads. I am inclined to believe we will get the whole package if and when we get the attack. This means atomic bombs of the suitcase size by native traitors and those who can infiltrate our country, introduction of plant and animal diseases, human diseases, and possibly the use of chemical warfare, and, of course, psychological warfare.

I have been saying to the American people for the past year that in view of the devastating character of atomic weapons—and I use "atomic" to cover all types of modern weapons, both atomic and thermonuclear or hydrogen—there is only one way to be certain of being alive after an attack.

That is, simply not to be in the town where an atomic bomb is dropped. We must forget the World War II concept of staying in a town, absorbing a bombing, and maintaining life and production somewhat as usual. It just isn't going to be that way in World War III if it comes. It is dangerous to think in terms of what happened in Germany and England. These new weapons are so devastating, that, while they will not completely destroy an American city, they will certainly gut it. If the Russians make the type of attack I think they will be capable of making when they strike, they will gut most of America's great industrial cities in one afternoon or one attack.

How can we not be in American cities and still maintain life in those cities? I know of only two practical ways. Certainly, it wouldn't be practical to abandon our cities. One way is to go down deep under the earth, far enough to get away from an atomic or hydrogen weapon. In porous soil, that would be 50 to 80 feet. We would have to construct concrete catacombs, reinforced with steel, with elaborate air conditioning systems, multiple entries and exits, gas filters, communications facilities, and living accommodations. All of these things would cost untold billions of dollars. Nobody has ever calculated how much it would cost to provide safe underground shelters for all the American people.

I saw such a system in Norway and Sweden last summer. The Norwegians and Swedes have discovered ways of creating a cubic foot of space in the granite upon which their countries are built for just a little more than it costs to build a cubic foot of space in a modern American apartment building. Also, maintenance costs are lower below ground. Strangely enough, workers like it better under the ground. With elaborate air conditioning systems and controlled humidity atmospheric conditions are better and more pleasant for working.

*The full text of Gov. Peterson's address is printed here pursuant to numerous requests of A.F.C.A. members for copies. A report of the symposium was made in the July-August issue of the Journal, however, the transcription of Governor Peterson's remarks in full was not available when the report was prepared.

†Maj. Gen. M. R. Nelson, U.S.A.F., Commanding General, Eastern Air Defense Force, whose symposium address immediately preceded that of Governor Peterson.

I saw a bomb shelter being built 50 feet under the center of Stockholm that will accommodate 20,000 people on two levels. There are several others in the city. Stockholm has a population of 800,000, a little smaller than metropolitan Washington. In Oslo, Norway, I saw one 40 feet under the center of town that takes 6,000 people. In Gothenburg, Sweden, I saw one 120 feet under the surface.

Norway and Sweden have electric power and water plants completely underground, the whole works; and telephone systems completely underground, except for the wires. The great Bofors factory employs the two principles necessary for survival in the atomic age—surface dispersal for 25 miles and part of the sensitive part of the plant underground. The Afca plant, which manufactures maritime devices used all over the world, and the SKF ballbearing plant are partly underground.

The Swiss are doing the same thing. We can do it in the United States if we want to put up the money. So far the Federal Civil Defense Administration has not recommended such a program. It may be necessary if the day comes when aircraft are supplanted by pilotless intercontinental ballistic guided missiles carrying atomic warheads and going thousands of miles an hour. Then warning time would be out. We would have to abandon our cities completely, stay in them and die when the bombs go off, live under the ground like moles, or have peace. The latter is such a simple solution, but man hasn't found it yet, and there is no indication that he will in the immediate future.

At any rate, I have been telling the people we have either got to dig, die or get out of the cities. Now, how are we going to get out? First, we have to have warning time. Giving the American people warning time is the responsibility of the Air Force, particularly of General Chidlaw and his Air Defense Command, in which General Nelson has an important part. As General Nelson has explained to us today, adequate warning depends on a detection net extending across the wastelands of Canada and Alaska, with parts of it in Iceland and Greenland, and arms sticking out to sea in both directions. If that detection system can be made good enough—and it is being improved as rapidly as American ingenuity, scientific ability and military work can do it—the time may come in a year-and-a-half or two years when we can have from two or three to five or six hours warning time.

If we can get from two to six hours warning time, the more the better—and the military needs it as badly as civil defense needs it—civil defense can alert the American people and urge them to get out of town, evacuate their cities as rapidly as possible, because enemy planes are on the way.

When you talk about evacuating a city, you are talking about a tough deal. I know how difficult it is to get downtown through traffic in the morning and home again at night. It will be one of the toughest problems in the history of the world to move the people out of these cities, but it can be done, and it must be done, because the alternative is certain death. We must get them out in a reasonably disciplined orderly manner, not an angry, milling, destructive, bitter mob, dangerous to themselves and everyone else. I have thought what would happen if Washington is evacuated simultaneously with Baltimore—and both cities are going to be attacked if there is an attack on the United States because they are big and important targets. What would happen to people living in a small town halfway between Baltimore and Washington if the two groups of evacuees met as an angry, ugly, milling mob?

I believe we can evacuate cities like Indianapolis and Columbus, Ohio—cities of half a million people, on flat terrain, not broken up by water—in much less than an hour and a half. We should put the best engineering and traffic control brains in those cities to work, train auxiliary policemen, and plan to use whatever troops are available, such as the National Guard troops. If we think about this problem, face up to it, plan for it, and then try it in a number of tests, I think we will be surprised at how fast we can get out the people.

I think we can evacuate Chicago. I think we can evacuate every city in the United States. In New York City we are up against a terrifically tough problem because it is divided by water. New Orleans is tough, Seattle is tough, San Francisco is tough with 800,000 people crowded on a little peninsula. Los Angeles presents some peculiar and difficult problems; Washington is not easy. But I think it can be done; whether we do it in an orderly fashion or not, the people are going.

Are you going to stay here if you hear a bomb is coming? Are you going to face an atomic bomb? I am not. I haven't faced one any closer than two miles at Las Vegas. That was a toy one, if you can call any of them toys, 15,000 tons of TNT equivalent. I was in the front trench with the troops, five feet down in the ground, and that is a good place to be when these bombs go off. The earth trembled like I imagine a great pile of jelly would if you stood on top of it. Next week the troops moved up to a mile and a half. But, bear in mind, they were dealing with small weapons. Now we face them in the hundreds of thousands of tons of TNT equivalent, and when we get into the hydrogen age, in the millions of tons of TNT equivalent.

Whenever a man says he is going to bare his breast and stand up to an atomic bomb, he is just talking about being vaporized, that is all. If that is his ambition in life, that is okay with me; but I want to stick around a while even after this attack occurs, because I think life will go on in this country and in this world. I don't think we are going to end it in one afternoon or a series of afternoons.

I propose this story for you because you are not only members of the Armed Forces Chemical Association or officers of the military in whatever branch; you are also citizens of this country, and you have wives and children at home, and mothers and fathers and aunts and uncles. I was very proud during the six years I was Governor of my State to be a member of General LeMay's Strategic Air Command on an M-day basis as a Deputy Director of Materiel. I believe in a strong striking Air Force, and I want the strongest Navy; ground force and Marines we can get too. I believe one of the main reasons Russia hasn't attacked this country is because we have had a strong military force with strong striking power. But, gentlemen, it isn't enough to be thinking about a strong striking power or a strong defensive power. Until the day we can be certain we can prevent bombs from falling on American cities, this country needs to be giving more thought to how to save the lives of Mr. and Mrs. America in these cities. We haven't given enough thought to that yet.

Now, getting back to evacuation. If we don't get people out of the cities, what is going to be the situation after attack? You could sit down with a pencil and paper and project that for yourself. It depends upon the number of bombers and bombs and their size. I have seen some capable scientists and military people project those figures. One figure projected a total of 22 million casualties if the Russians attacked us in the afternoon or evening and caught the people in the cities. 22 million casualties. Just roll that around in your mind for a while. Of that number, I believe they said 7 million would be dead.

The other 15 million casualties would be suffering from various degrees of injury. Do you know how many people

the American Medical Association says we can take care of medically in this country at any given time? Five million. We don't have doctors, nurses, veterinarians, dentists, or trained first aid people to take care of more than 5 million.

What are you going to use for money after an attack that destroys the banks in 50 or 65 American cities? Who is going to handle the credit problems the next morning?

Once in a while I hear somebody in the miltary talk as though we were going to launch an expeditionary force after an attack. My guess is that there won't be any troops going anywhere for a year and a half after that takes place. Why do I guess that? Because there won't be any ports left, and if ships are in the ports, there won't be any ships left.

We aren't going to go anywhere. If 22 million Americans are dead and dying and injured, our first job is going to be to get America back on its feet. That is why I am so adamant about getting people out of the cities. We can rebuild American cities, but we can't rebuild a generation of Americans in a short time, and we can't replace their skills and ingenuities and imagination overnight. That is why we have got to get them out of the cities.

Bear this in mind. If the 67 major metropolitan complexes in the United States are hit, the industrial guts of America are on the ground, but only about three percent of the real estate is attacked. America hasn't been destroyed, even after you have done that damage, and if we have the will to get up and fight, we can still win the war.

Now, if we want peace at any price, we can arrange to have that peace; and we won't need to have the attack. All we need do is to surrender if that is the approach we want to take.

Some people say this thing is so hopeless that you might just as well not worry about it. I don't agree. I certainly hope the United States is never attacked. If it is, it is not much consolation to me that we can clobber the Russians—do an even better job of it—a few hours after they hit us. That involves one very important assumption on our part: that the Russians don't catch half or two-thirds or three-fourths of LeMay's strategic bombing outfit on the ground. If that happens, America will suffer the greatest catastrophe that it has ever suffered, because there won't be any retaliation for a long time. But I still believe that even as devastating as that kind of attack would be, Americans have the stuff to get on their feet again, if they have thought about this thing and prepared for it. They will get ready next morning to go ahead and win the war. There is no other choice if we want to be free men.

Now, getting specific, any discussion of civil defense as it applies to industry seems logically to include these nine points:

No. 1. Industry is the target. It comprises plants and the people who man them. Let us recognize that no future enemy will make the same mistake as our enemies made in the past; namely, tangling with our military forces and leaving our industrial production intact. Let us recognize also that our industrial production centers are particularly vulnerable, due to concentrations and interdependence of plants; and that we can rebuild machinery in a relatively short time, but it takes nearly twenty years to create a trained industrial worker.

No. 2. Survival of industry and recovery from a devastating attack cannot be left to chance. It is not automatic. It will result only from months or even years of planning, preparing plant equipment and personnel for such an attack and organizing and training emergency forces to cope with it.

In industry particularly, activities must include measures taken before, during, and after an attack to offer positive resistance to effects of blast, fire, and a general disarrangement. Above all, industrial civil defense must be coordinated with efforts being taken throughout the nation to alleviate the results of mass destruction weapons on property and people.

No. 3. The organization and operation of a civil defense plan within an industrial or commercial establishment follows a well-defined pattern. The details of necessity vary from plant to plant but essential principles are clear. There must be effective leadership—the responsibility of the owners and operators of these facilities. There must be sound preparations of a physical nature to protect personnel and equipment, such as dispersal, the strengthening of structures, etc. There must be organized casualty services, trained and equipped to handle multiple injury cases in unprecedented numbers, together with trained rescue teams to release entrapped persons, dead or alive. There must be plans for emergency repairs of plant buildings and machinery in connection with over-all restoration and rehabilitation plans emanating from government levels. There must be systematic coordination of survival plans within individual plants with those of other plants, and above all with those of the community in which the plants are located. There must be a systematic plan for the safety of records and other documents essential to further operation of the plant—evidence of title, fiscal records, production records, blueprints, formulas, etc.

It is necessary to recognize at this point, that since this country depends upon a well-established credit system for fiscal operations, we cannot have a breakdown at the plant level of the evidences of credit needed for business continuation after a disaster.

When I was in Denmark, I found they had already built an underground repository outside Copenhagen in which they expected to put all the great art treasures of Denmark, as well as government records. We need to be thinking of that sort of thing in the United States, and for valuable business records as well.

No. 4. There are many possible solutions to the problems of individual plants. People at the plant are in the best position to determine which solution best fits their particular needs.

Dispersal in civil defense would involve advance relocation of industrial and commercial establishments to reduce vulnerability and lessen the advantages to be gained by an attack on the country. But dispersal is not always feasible. Those who cannot relocate must be prepared to withstand the forces released by modern weapons, and to get back into production with a minimum of lost time and effort.

In other words, some parts of industry should go underground. Some parts of it should be placed in buildings that have been tremendously strengthened. The enemy bomb isn't going to explode exactly over the center of each one of our plants; and when these bombs are dropped, they are not going to be dropped precisely on their aiming points. It becomes somewhat of a gamble. Your plant may be located far enough away from the actual bomb burst so, if you have taken some of these steps, you will be able to survive.

I don't have too much confidence in Washington's attempting to blueprint individual solutions. It is up to individual industrialists to think about these things themselves. In an emergency they will have to direct such emergency operations as will save lives and property. Furthermore, they should recognize that they will not be able to rely on the usual public safety services for protection in an emergency. The safety efforts will ordi-

narily be directed elsewhere. Damage and injuries received under such circumstances must be handled by those already at the scene, and they must be prepared to handle them. You can't figure out these things after the bomb goes off. That will be too late.

Such a responsibility is nothing new to industry. Civil defense in a plant will be an extension of normal protective measures, coldly realistic and calculated to handle a hazard of disaster proportions.

No. 5. Even by the most optimistic estimate there will never be enough of the resources necessary in terms of both manpower and equipment to meet all of the dangers accompanying an attack upon the country.

We must pool our emergency resources, both in the preparation and operational stages. Public and private enterprise must become a team in preparing for the defense of our continent.

We must anticipate a maximum damage situation and hope for something considerably less, looking for the military defenses to make it less. In a sense we cannot overestimate our requirements. We could underestimate to our everlasting sorrow.

May I say something that needs to be said over and over again? Let's stop underestimating the Russians. Anything we can do, they can do. Let's not assume that we have some mysterious quality that enables us to do things easier and better and simpler, and consequently keeps us safe. That is utter nonsense. They are doing a better job than we are of training scientific people, physicists and others in their schools. I don't mean any reflection on our schools. They simply have a bigger program. Any outfit that can make the MIG airplane can make first rate modern atomic bombers to carry bombs over here, too, and if we think they can't make them or don't have them, we are kidding ourselves again. And the same thing applies to their submarines and everything else.

I used to coach football, and the most trouble I got into was when I underestimated the other fellow. I think all good commanders know that you must not underestimate the enemy, and the American people must not underestimate the enemy.

Our plans must be so complete and so sound that emergency confiscation powers provided for in the Act which I administer, and again in many of our state civil defense acts, will never have to be invoked.

No. 6. Industrial leaders should be satisfied that those who will have the power to seize and use their equipment and other resources are properly competent to exercise this power in an effective manner. The only way you can be sure about that is to cooperate with the public authorities in the development and staffing of effective civil defense organization and plans. In some cases it may be necessary for industry to assume leadership in the establishment of civil defense in their community. If you want better men in civil defense, then put some in there. That should be enough of a tip.

No. 7. There is no magic protective dome which can be lowered over a plant to avert damage to property and injury to personnel.

No. 8. In the industrial defense picture, as in all of civil defense, there are two approaches to civil defense: First, there are those who will be dependent upon assistance from others in an emergency, largely because they failed to take adequate precautions in advance; second, there are those fine, patriotic, sensible American people who are making preparations right now themselves for a possible emergency.

Yesterday I had in my office representatives from three great American industries, men who came in with detailed plans for plant protection, complete in every respect. All industry will have to get into this field.

No. 9. The effort by the government to create and operate a national system of continental defense suggests a two-fold role to be played by industry: (1) organize and operate an adequate defense program within each plant, coordinated with similar programs of other plants and of the communities in which such plants are located; and (2) call upon your know-how, technical skill, and insatiable mechanical curiosity to devise better ways and means of carrying out the many complex problems which beset the nation's continental defense effort.

The military can't do it for us this time. Nobody can do it for us. Washington can't. Annapolis, the capital of Maryland, can't; the Mayor can't. If Mr. and Mrs. America want to survive a possible atomic war, Mr. and Mrs. America will have to do the job themselves. This is bigger. You couldn't hire enough men, you couldn't uniform enough men to meet the problem that would be posed by an atomic attack upon this country. Every citizen will have to participate in this activity.

Now, let me say just a word or two about the chemical aspects of our problem. When I was in Stockholm last summer I noticed elaborate gas filtering units in the bomb shelters. The Swedes told me very candidly and openly, with nothing secret about it, "In event of World War III, we expect this country to be attacked immediately and we believe as of now the Russian communists will use gas on us."

Now, will gas be used in the United States? I don't know. You don't know. But considering the type of enemy, I believe he will not hesitate to use gas upon the United States if it suits his purposes. Some people believe that gas would be a very effective weapon to use against a great concentration like New York City. As a matter of fact, it is not such a foolish way to fight a war, because if you drop one of these confounded atomic bombs, you destroy everything; you gas a place and after the gas dissipates, you can move in and take over the wealth and the property, and that is a kind of sensible way to fight a war. I am not advocating it, you understand; I am thinking now in terms of the communist approach to this subject.

Now, I say it is a sensible way to fight a war. If you read history, you will find that is about the way they used to fight in the old days. And isn't it amazing how far back toward the old days we have got? Every inhumanity man ever practiced against man, we have relearned in the last twenty years, and added a couple of new tricks of our own modern civilization.

This chemical business worries us in civil defense and it worries us tremendously. This country, I think it is fair and honest to say and violates no security, is largely unprepared for gas attack. We have been trying to figure out in civil defense some kind of a gas mask—and we have had the utmost cooperation from all elements of the military, particularly the Chemical Corps—that people could buy at the corner drugstore for about two dollars.

Ladies and gentlemen, this country needs to face up to this problem—my agency is facing up to it—and we need to squawk even louder than we are about the need for chemical defensive measures for Mr. and Mrs. Civilian. We are doing the best we can at the present time, but it certainly is not adequate to the problem. We have drawn up a nine-point gas defense program that I am not going to take the time to read to you people because you know more about gas and gas defense than we do. But it is a serious problem and one that justifies more attention than it has had up to the present from all the authorities in the United States.

It has been a pleasure to be here with you this afternoon. I join you in looking forward to hearing General

(Continued on page 40)

PIONEERING IN CIVILIAN DEFENSE

By George J. B. Fisher

An interesting resume of the early concerns and activities of the Chemical Corps with Civil Defense which foreran the inauguration and development of a Civil Defense organization in this country. Colonel Fisher, the author, has written extensively on chemical warfare subjects. He is currently a consultant of the Historical Office of the Chemical Corps.—Editor

The Journal has undertaken an important public service in pointing out the continuing importance of a well balanced civilian defense program geared to the technical realities of modern warfare. Expert guidance by the Chemical Corps will always be needed in connection with some aspects of this program. Indeed, the Chemical Warfare Service pioneered in advocating government planning for civilian protection some years before the beginning of World War II and made very substantial contributions to the success of the project after it finally got under way. This work was never especially publicized, yet the experience gave ample proof of the type of technical assistance the Chemical Corps will be called on to provide in future.

It was in about 1930 that CWS concern with civilian defense began to develop. At this time the subject was of little interest in the United States. An early student in his field was Col. Charles R. Alley. This CWS officer, while on duty as an assistant military attache at the U. S. Embassy in Paris, gained first-hand knowledge of the growing apprehension of all European governments under the looming possibilities of aerial bombardment. Public thinking at this time was considerably influenced by the writings of the Italian air warfare theoretician, Guilio Douhet, many of whose predictions as to strategic bombing have been fulfilled. Douhet believed that toxic gas would be an important weapon in aerial bombardment of cities and his doctrines influenced the beginnings of antigas protection for civilians—something that had previously concerned only soldiers.

When Colonel Alley returned to Washington and was assigned to duty in the Chief's office he was struck by the apathy with which civilian defense was regarded in this country. The notion of an overseas power attacking the United States by air was still generally held to be fantastic. Alley nevertheless formulated some proposals, based on European measures, which if not immediately acceptable at least served as a forerunner of numerous recommendations presented to War Department General Staff by CWS during the following decade. Other CWS officers assigned to attache duty at European capitals (of whom the present editor of the Journal was one) followed Colonel Alley's example in observing and reporting current developments in civilian defense. Soon the Chief's office became well posted on plans and procedures being worked out abroad.

CWS Best Informed On Subject

It thus transpired that in the early 1930s the Chemical Warfare Service was probably the best informed agency of our government on the subject of protecting civilians against air attack. General Brigham and, in turn, General Baker were convinced that the War Department had an inescapable responsibility in widening the sphere of national defense to include some measures of civilian protection. Both, however, encountered difficulties in informing WDGS with this view. There existed in those days a strange reluctance to undertake any action that might alarm the public as to the facts of life in an era already darkened by the rising shadows of Mussolini and Hitler.

Matters of civilian protection came, by a process of elimination, within the sphere of responsibility of the War Plans Division of the Staff. The only WPD section having duties that were at all analogous was the one concerned with coastal protection. When this section was directed by Col. Sherman Miles, in 1936, the first steps were taken by the War Department in the civilian defense field. Miles was a graduate of the Chemical Warfare School, he understood the possibilities of protection against gas attack, and he felt that the times clearly called for some action by the War Department that would enable it to meet questions that were then frequently arising. In conference with General Brigham, a modest program was agreed upon which included the formulation of instructions to military authorities and the imparting of information to the general public. The keynote of these measures was conservative. What was accomplished was at best a compromise between what one group thought needful and what another and more authoritative group regarded as permissible.

Manual On CD Classified Secret

It was decided to provide appropriate instructions to the military in a manual setting forth principles of civilian protection and indicating the responsibilities of senior commanders in case of hostile air action against targets within the United States. The task of preparing this manual was delegated to the Chief, CWS. The reason for this selection was obvious. The effects to be protected against were those of high explosives, gas, and incendiaries. Thus two of the three prospective air weapons were chemical munitions. Protection from the blast and fragmentation of explosive bombs was principally a matter of structural protection, which fell within the field of the Corps of Engineers. The Medical Department was necessarily involved as to health measures, while Ordnance alone had expert knowledge in handling unexploded bombs. Yet CWS was considered to have preponderant interest and so was given overall responsibility in assemblying material for this pamphlet. An edition of one hundred numbered copies was printed at the Chemical Warfare School reproduction plant, under the title of *Passive Defense against Air Attack*. These the War Department distributed as secret documents to corps areas and departments, where they were presumably consigned to triple-combination safes to be pulled when needed. One might be permitted to wonder how quickly the Fort Shafter copy was located after the fateful morning of 7 December 1941.

As a feature of the measures for informing public opinion, as concurred in by WDGS, an article was prepared by the Chief, CWS, and published in the Saturday Evening Post the following year under the title, "How

Serious is this Gas Menace?" The theme of this article was that, although gas attacks against the United States mainland were feasible, their effects could be limited by well-conceived defensive measures.

This same theme served to underwrite the whole CWS approach to gas protection of civilians. It inevitably led to the question: If damages can be so limited, then why should an enemy attack us with gas? The answer was equally cogent: No enemy will strike with gas if he sees we have well-established protective means. Whether the converse of this was true or not was never a concern of the Chemical Warfare Service. Those who believed in air power inclined naturally to the view that a hostile nation, seeing the United States unprepared for gas attack, would employ toxic agents against us.

This period (the mid-1930s) is notable in our national history as the days of the last stand of those who believed that "It Can't Happen Here." Something of this attitude lingered on, of course, to be reflected in the disaster at Pearl Harbor; yet the decline of obscurantism in Washington may be dated fairly well by the first tentative steps taken within the War Department toward a civilian defense program.

Emphasis Shifts to Fire Danger

In these early actions emphasis on protection against gas was evident, our thinking in this respect being considerably influenced by what was being done abroad. But already in 1936, as we were beginning to approach civilian defense thoughtfully in this country, fear in Euorpe was noticeably shifting from gas to the new menace of incendiary warfare. The assurances of fairly effective protection against available toxic agents, including general distribution of gas masks to civilians in Europe, caused strategic warfare planners to examine other means, in addition to explosive bombs, for striking industrial targets. This poised a new question: Could fire be protected against as satisfactorily as gas?

No one knew the answer. Certainly the incendiary bombs used in World War I had been nothing to brag about. Yet it was generally understood that Germany possessed a really effective fire-raising device that had never been used. Ludendorf, in his memoirs, frankly stated the reason.[1] The composition of this bomb became came known to the Allies after the war as a magnesium-thermite mixture in a magnesium alloy casing. If this were used extensively, then considerable reinforcement of existing fire defense organization appeared necessary. The sensitiveness of the leading military powers to approaching war was reflected by the rapid development, prior to 1939, of civilian fire-fighting arrangements. This was particularly noticeable in England, France, Japan, and to some extent in Germany.

The magnesium bomb had no apparent application to tactical warfare and its employment against strategic targets in the United States was questionable, at least until its possibilities had been proven in actual air operations. Nevertheless, the long-term implications of this weapon were not overlooked by the Chemical Warfare Service.

A detailed memorandum prepared for Chief, CWS, in 1936 by Col. J. Enrique Zanetti, CW-Res[2] discussed the possibilities of the magnesium bomb and outlined procedures for combating its effects, with particular reference to situations that might confront the New York City Fire Department. The proposition advanced by Colonel Zanetti, and always supported by the Chemical Warfare Service, was that the handling of fires started by incendiary bombs was entirely a responsibility of civilian authorities. Yet the Army possessed the technical knowledge upon which incendiary defense had necessarily to be based and should make this knowledge available to civilians when needed.

CD Policy Requested in 1939

After preparation of the passive defense pamphlet in 1936, no further action was taken by the War Department in civilian defense matters until early in 1939, when Maj. Gen. Walter C. Baker (then Chief, CWS) requested that a policy be announced as to military responsibility for the protection of U. S. nationals in case of penetration of our air defenses. Problems that were then confronting CWS included arrangements for producing civilian gas masks, channels for releasing authoritative information as to hazards from gas and incendiary attacks, and the training of selected civilians in the technical features of air raid protection. At that time the United States was the only major power that lacked any type of national civilian defense organization, and calls being made upon CWS indicated need for a definite policy as to what could or could not be done to assist local defense agencies that were beginning to appear in eastern cities. General Baker's recommendations provided the basis for a staff study, which was completed shortly after the invasion of Poland and which served to guide the Army's work in civilian defense during the war.

When the Luftwaffe began bombing London in 1940, the "electron" incendiary of 1918 was brought forward and soon was playing an important role in the Battle of Britain. It demonstrated beyond question the effectiveness of modern fire bombs. The British at the same time were demonstrating how effective—in fact, how vital—planned civilian fire protection had become in the anti-aircraft defense team.

These developments were closely observed on this side of the Atlantic, especially by cities on the eastern seaboard. In June 1940 the New York City fire commissioner (John J. McElligott) sent a special representative to Washington to confer with CWS on the question of training fire-fighter personnel in combating incendiary bombs and poison gas. This and similar requests led to the issue of War Department instruction to CWS that suitable instructions be prepared "to furnish local civil defense organizations with information as to the methods employed in chemical warfare and the means of combating them."

In the fall of 1940, the National Board of Fire Underwriters asked CWS if a demonstration could be staged to show, for the benefit of fire protection specialists, the operation of magnesium and oil incendiaries. In compliance, an exhibition was put on at Edgewood Arsenal on 9 October 1940, which proved to be the forerunner of hundreds of such demonstrations later conducted by CWS in every part of the country.

The work accomplished before the war in advancing civilian defense, like all pioneering efforts, was something of an up-hill pull. There were many people then, and quite a few now, who consider time spent in instruction of civilians as so much waste of military effort. Without arguing this narrow view, one point is crystal clear, civilians, in modern war, are forced to provide for their own protection. To do this, in an age of growing technical complexities, they must turn increasingly for help to those having requisite technical knowledge. The source of light on gas, incendiary, and biological warfare, and in some aspects of radiological defense, is in the Chemical Corps, and under proper circumstances it will unquestionably be made available to civilian defense agencies.

(1) Ludendorff's Own Story, Harper & Bros. N.Y. 1919: Vol. II, pp 351-352.
(2) Filed in Chemical Corps Historical Office.

GOV. VAL PETERSON

(Continued from page 37)

LeMay tonight, and ask for any help you can give to us in this civil defense undertaking. I can only say to you that after living with this problem for 15 months, I still sleep every night and eat three good meals a day, and hope I can continue. This is a tough deal we face, a tough age we live in, but we are equal to it if we will just keep our chins up and use our heads. Thank you a lot.

COL. McLEOD'S TRIP

(Continued from page 33)

complete dinner. After having bounced around on military planes and subsisting on K rations or box lunches, I could hardly believe my eyes. About nine o'clock we were asked if we would care for another little snack before we went to bed. After that I was shown to my bed which was similar to and about the size of a Pullman berth. The next morning I went back to the central compartment and was served fruit juice, toast and coffee. I figured that would hold me nicely until we arrived in San Francisco. However, as soon as everyone was up the table was set again and a regular breakfast including bacon and eggs was served.

We landed at Treasure Island about 11:00 a.m. and went to a waiting room for clearance by the customs. The waiting room was also very comfortable and we were again served refreshments while we waited to clear. I doubt if any airline ever had a more satisfied customer.

After a brief pause in San Francisco I returned to Washington and submitted my report on the trip. As a result of my survey it was decided that the Chemical Warfare Service should establish a jungle proving ground. Such a proving ground was later set up and called the San Jose Project.

CHEMICAL CORPS BRIEFS

(Continued from page 21)

ACC SERVICE PIN

The Employees Welfare Association at the Army Chemical Center, Maryland, has adopted a specially designed gold pin for presentation to employees after 15, 20, 25 or 30 years of service. The 30-year service pin is set with a ruby. More than 500 employees qualify for receipt of these pins.

CHEMICAL CORPS SCHOOL

An overall percentage of 87.21, highest in the current series of courses, was scored by the members of the Fourth Chemical Officer Basic Course class graduated recently in ceremonies at the Chemical Corps School, Ft. McClellan, Alabama.

The top average grade for all subjects in the 15-week course was 95.14.

Numbered among the graduates were two officers of the Republic of Korea Army. Watching them graduate were three other South Korean officers who have arrived in order to take the next Basic Course.

PINE BLUFF AWARD WINNER

Mr. James Wesley, explosives operator at Pine Bluff Arsenal, Pine Bluff, Ark., is first employee of Arsenal to receive the difficult-to-earn "Outstanding performance" rating. The picture shows him (right) receiving written notice of the award from his foreman, Mr. Palmer James.

NEW ARSENAL COMMANDER

Lt. Colonel Allan C. Hamilton, former chemical staff officer with the Seventh Army in Europe, has been named commanding officer of Edgewood Arsenal, Army Chemical Center, Md. He succeeds Major John Moran, who is attending the Command and General Staff College at Leavenworth, Kansas.

MEDICAL LAB EXECUTIVE

Lt. Colonel Ledru H. Savage has been named Executive Officer of the Chemical Corps Medical Laboratories at the Army Chemical Center, Md.. A biologist, Colonel Savage holds B.S. and M.S. degrees from the New Mexico College of Agriculture & Mechanical Arts. He served in the European Theater of Operations during the war and afterward returned to New Mexico as Assistant State Director of the Farmers Home Administration, U. S. Department of Agriculture. From 1948 to 1949 he was on loan to the Rockefeller Foundation and was sent to Venezuela for agricultural research. He was recalled to active duty in October of 1953.

NEW JUDGE ADVOCATE AT ACC

Lt. Colonel William E. Parker is the newly assigned Staff Judge Advocate at the Army Chemical Center. A New Englander, Colonel Parker is an alumnus of Boston University, and also attended Norwich University and the University of Maryland. He was practicing law in Northampton and Easthampton, Mass., when called to active duty in 1942, and has served tours of duty in Germany and Korea.

RECEIVES OAK LEAF CLUSTER

Colonel Joseph H. McNinch, newly assigned commander of the Army Environmental Health Laboratory, a part of the Army Surgeon General's office, located at the Army Chemical Center, Md., recently received the Oak Leaf Cluster to the Legion of Merit in recognition of service as Preventive Medicine Chief, Medical Section, Far East Command.

CHEMICAL CORPS KEY PERSONNEL

OFFICE OF THE CHIEF CHEMICAL OFFICER

Chief Chemical Officer—Major General William M. Creasy
Deputy Chief Chemical Officer—Major General Charles E. Loucks
Executive Officer, OCCmlO—Colonel William E. R. Sullivan
Chief Administration Division—Lt. Colonel James B. Costello (Acting)
Chief, Plans, Training and Intelligence Division—Colonel Frank M. Arthur
Chief Research and Development Division—Lt. Colonel Vincent F. La Piana (Acting)
Chief, Materiel Division—Colonel Joseph F. Escude
Comptroller of the Chemical Corps—Colonel James H. Batte
Legal Adviser—Lt. Colonel Herbert K. Greer
Chief, Program Coordinating Office—Colonel William H. Greene

GFFICE OF ASSISTANT CHIEF CHEMICAL OFFICER FOR BW (CAMP DETRICK, MARYLAND)

Asst. Chief Chemical Officer for BW—Colonel John J. Hayes

ARMY CHEMICAL CENTER, MARYLAND

HEADQUARTERS

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Deputy Commander—Colonel Walter L. MacLachlan

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HEADQUARTERS

Commanding General—Brigadier General Marshall Stubbs
Deputy Commander—Colonel Claude J. Merrill

ARMY CHEMICAL CENTER INSTALLATIONS

Edgewood Arsenal
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Eastern Chemical Depot
Commanding Officer—Colonel John P. Youngman
Inspection Equipment Agency
Commanding Officer—Major John Marrero
Technical Escort Detachment
Commanding Officer—Colonel Garland M. White

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Atlanta Chemical Procurement District, Atlanta, Georgia
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Boston Sub-Office, New York Chemical Procurement District, New York, N. Y.
Commanding Officer—Major Charles D. Manes
Chicago Chemical Procurement District, Chicago, Illinois
Commanding Officer—Lt. Colonel Charles H. McNary
Dallas Chemical Procurement District, Dallas, Texas
Commanding Officer—Lt. Colonel Edward N. Fitzgerald
New York Chemical Procurement District, New York, New York
Commanding Officer—Lt. Colonel Frederick J. Hurley
San Francisco Chemical Procurement District, Oakland, California
Commanding Officer—Lt. Colonel William A. Johnson Jr.

DEPOTS

Deseret Chemical Depot, Tooele, Utah
Commanding Officer—Colonel Nelson I. Decker
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Memphis General Depot, Memphis, Tennessee
Section Chief—Colonel Willis R. Robbins
New Cumberland General Depot, New Cumberland, Pennsylvania
Section Chief—Major Alva G. Bearden
Utah General Depot, Ogden, Utah
Section Chief—Captain Fred S. Weston

ARSENALS

Pine Bluff Arsenal, Arsenal, Arkansas
Commanding Officer—Colonel Robert W. Breaks
Rocky Mountain Arsenal, Denver 2, Colorado
Commanding Officer—Colonel Adam W. Meetze

CHEMICAL CORPS RESEARCH AND ENGINEERING COMMAND

HEADQUARTERS

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Deputy Commander—Colonel Donald H. Hale

ARMY CHEMICAL CENTER INSTALLATIONS

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Chemical Corps Medical Laboratories
Commanding Officer—Colonel Norman W. Elton (MC)
Chemical Corps Engineering Agency
Commanding Officer—Colonel William J. Allen Jr.
Chemical Corps Research Procurement Agency
Commanding Officer—Lt. Colonel David D. Hulsey
Dugway Proving Ground, Dugway, Utah
Commanding Officer—Colonel Donald D. Bode

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HEADQUARTERS

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USARPAC—Lt. Colonel Richard O. Gordon
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THIRD ARMY, FORT McPHERSON, GEORGIA—Colonel Ronald L. Martin
FOURTH ARMY, FORT SAM HOUSTON, TEXAS—Colonel Richard R. Danek
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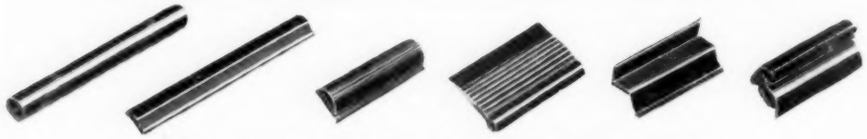

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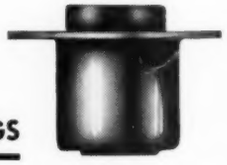

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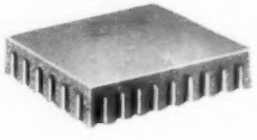

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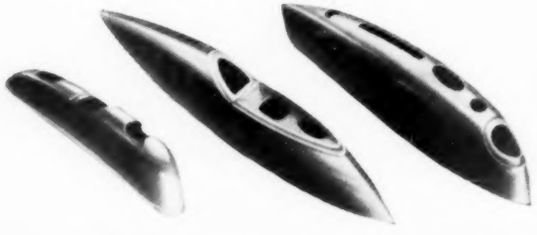

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